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De Immortalite Animæ

Auctore your Lovingh. Father

J. H.

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TWO TREATISES.

IN THE ONE OF WHICH,

THE NATVRE OF BODIES;

IN THE OTHER,

THE NATVRE OF MANS SOVLE;

IS LOOKED INTO:

IN WAY OF DISCOVERY, OF THE

IMMORTALITY

OF

REASONABLE SOVLES.

Ψυχῆς φύσιν ἀξίως λόγου
Κατανοῆσαι οἷός δυνατὸν εἶ),
Ανθ' τῆς τ' ὅλου φύσεως;

Anima naturam, absque totius natura,
Sufficienter cognosci posse, existimas?

Plato in Phœdr.

AT PARIS,
Printed by GILLES BLAIZOT.

M. DC. XLIIII.
WITH PRIVILEDGE.

For father Coniers

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TO MY SONNE KENELME DIGBY.

SONNE,

The calamity of this time being such, as hath bereaft me of the ordinary meanes of expreſsing my affection to you; I haue beene casting about, to find some other way of doing that in such sort, as you may receiue most profit by it. Therein I soone pitched vpon this consideration; That Parents owe vnto their children, not onely materiall subsistence for their bodie; but much more, spirituall contributions to their better part, their minde. I am much bound to God, that he hath endewed you with one very capable of the best instructions: and withall, I do therefore esteeme my selfe obliged, to do my vtmost for moulding it to its most aduantage. If my ayme therein do proue successefull, you will with more ease digest those inconueniences and distresses, which already you haue begun to be acquainted with, and that threaten dayly worse vnto you. For how can a man suffer his hart to be deiected att the priuation of any temporall blessinges, whiles he considereth the inanity of them; and that nothing is worthy his serious thought, but what may accompany him to his eternall habitation? What needeth he feare the desolations of warre, and the worst that they can do against him, who haue his estate in their power, when he may be rich with a much nobler treasure, that none but himselfe can robbe him of? Without doubt, he that shall seriously reflect vpon the excellency of his owne nature, and vpon

the admirable perfect and happy state he shall most certainely arriue vnto, if he but weane himselfe from those worldly impediments, that here clogge his soules flight; can not choose but looke with a disdainefull eye, vpon the glittering tryfles, that weake spirits delight themselues withall. If he deeme it not requisite (as of old, the famous wise man did) to throw away those encumbrances, to the end he may the more freely attend vnto diuine contemplations (for worldly goods, duely vsed, may be very aduantagious both to ones selfe, and to others) yet at the least, he will not repine att fortunes recalling of what she formerly had but lent him, and but permitted him the vse of.

To the end then that you may be armed against the worst that may arriue vnto you, in this vnhappy state of affaires, in our distressed country; I send you those considerations of the nature and Immortality of humane soules, which of late, haue beene my chiefe entertainement. The progresse you haue already made in the study of Philosophy, hath (I am perswaded) enabled you to benefitt your selfe, with what I haue written vpon this subiect: on the serious examining of which, if you will employ but halfe the time, that I haue done in spinning out my thoughts, and weauing them into the piece you see, I doubt not but you will thereby receiue so much contentement, as well as profit, that you will not repent you of your paines. Besides that, intellectuall entertainements are the purest, and the noblest, and the most proportionate to mans nature, and proue the most delightfull to him, when they are duely relished. You will presently agree, that the matter j handle, is the most important and the most weighty, within the whole extent of humane nature, for a worthy and a gallant person to employ himselfe about. The aduantage which man hath ouer vnreasonable creatures, is, that what he doth, is by election; and he is himselfe master of all his actions; whereas they are impelled by outward causes, vnto all they doe: it is properly sayd of them, that aguntur magis quam agunt: *He onely is free: and in all varietyes of circumstances, hath the power to choose one, and to reiect an other. Now, to haue this election wisely made, and becoming a man, requireth that it be steered by knowledge. To do any thing well, a man must first know throughly all that concerneth the action he is about; and chiefely the end of it. And certainely, of all his actions, the gouernement of himselfe, is the most important, and neerelieſt*

concerning

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concerning him. The end of that gouernement, and of all a mans aymes, is by all men agreed to be Beatitude: that is, his being completely well, and in a condition of enioying the moſt happineſſe, that his nature is capable of. For arriuall whereunto, it is impoßible to pitch vpon thedirect and ſure meanes, vnleſſe it be firſt determined, whether the Beatitude weſpeake of, do belong to this life, or be not to be attained, till we come to the next: or rather, whether or no, there be an other life beſides this, to be happy in. For if there remaineth an eternity vnto vs, after the short reuolution of time we ſo ſwiftly runne ouer here on earth; it is cleare, that all the happineſſe which can be imagined in this fleeting ſtate, is not valuable, in reſpect of the future; nor any thing we do here is conſiderable, otherwiſe then as it conduceth to the making our condition then, better or worſe. Now the way to be ſure of this, is eyther infallible authority, or euident ſcience. They that rely on the firſt, depend of others: and they onely who know, are abſolutely complete of themſelues; and haue within themſelues, the principles whereby to gouerne their actions, in what is of higheſt conſequence to them. It is true, euery body is not of a ſtraine of witt and iudgement, to be of this ranke: and who are not, muſt be contented to beleeue others, and be ſatisfyed with what is taught them. But he that will be of a ſuperior orbe, muſt make this his ſtudy. This is the adequate entertainement of a worthy perſon.

To conceiue how high and excellent, this ſcience of gouerning a man in order to Beatitude in the next world is, we may conſider, how among all arts that concerne this life, the art of a ſtatesman, vnto whome belongeth to ſee a common wealth well gouerned, is by much the nobleſt. All other arts, are but miniſteriall to him. He maketh vſe of the ſoldier, of the lawyer, of the orator, of the antiquary, of the phyſitian, as beſt conduceth to the end he aymeth att, of making the common wealth he gouerneth, happy and flouriſhing. All other meaner trades ſerue him in a yet lower degree. Yet after all, he muſt take his meaſures from the Metaphyſitian or Diuine. For ſince the gouernement of a ſociety of men, aymeth att giuing them the beſt being they are capable of; and ſince Mans well being here in this life, is but inſtrumentally good, as being the meanes for him to be well in the next life; It is euident, that the ſtatesmans art, is but inſtrumentall to that, which sheweth, how euery particular man muſt

gouerne his life, to be partaker of a happy eternity. And consequently, if a statesman haue not this science, he must be subiect to a brauer man then himselfe, whose prouince is to direct all his actions vnto this end. We are told, how reuerently great Cesar listened to the discourses of learned Achoreus, how obseruant Alexander was of his Master Aristotle, how secure Nero trode, whiles Seneca guided his steppes, how humble Constantine was to saint Syluesters precepts, how Charlemaine gouerned himselfe in his most important actions, by Alcuines aduise: In a word, all the great men of antiquity, aswell among the Romanes, as among the Gretians, had their Philosophers, and Diuines in their kind, belonging to them; from whome they might deriue rules of liuing and doing as they ought vpon all occasions, if themselues were not Masters in that superior and all directing science. He that seeth not by his owne light, must in this dangerous ocean steere by the lanterne which an other hangeth out to him. If the person he relyeth vpon, eyther withholdeth the light from him, or sheweth him a false one, he is presently in the darke, and can not faile of loosing his way. How great an authority had the Augurs and priests among the rude Romanes, to forbid any publike act, or to breake any assembly vpon pretence of Religious duties, when they liked not the businesse that was in agitation? The like may interessed Diuines among Christians do, if the ministers of state haue not some insight into Diuinity. He leadeth a vexatious life, that in his noblest actions is so gored with scruples, that he dareth not make a steppe, without the authority of an other to warrant him.

Yet I do not conclude, that he whome I design by the character of a braue man, should be a professed or a complete Metaphytian or Diuine, and consummate in euery curious circumstance that belongeth to this science; it sufficeth him to know it in bulke; and to haue so much Diuinity, as in common occurrents, to be able to gouerne himselfe; and in speciall ones, to vnderstand what, and why his Diuine perswadeth him to any thing; so that euen then, though not without helpe, yet he gouerneth himselfe, and is not blindely gouerned by an other. He that aymeth att being a perfect horseman, is bound to know in generall (besides the art of riding) the nature and temper of horses; and to vnderstand the different qualities of bittes, saddles, and other vtensiles of a horseman; But the vtmost exactnesse in these particulars,

belongeth

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belongeth to farriers, saddlers, smithes, and other tradesmen; of all which, the iuditious rider knoweth how to make due vse, when he hath occasion, for his principall end; which is, orderly gouerning his horse. In like manner, he whom we designe by a complete braue man, must know solidely the maine end of what he is in the world for: and withall, must know how to serue himselfe when he pleaseth, and that it is needfull to him, of the Diuines high contemplations, of the Metaphysitians subtile speculations, of the naturall Philosophers minute obseruations, of the Mathematicians nice demonstrations; and of whatsoeuer else of particular professions, may conduce to his end; though without making any of them his professed businesse.

To lay groundes for such knowledge as this, is the scope of my ensuing discourse. My first ayme, was to begett it in my selfe: to which end, the digesting my thoughts into order, and the setting them downe in writing, was necessary: for without such strict examination of them, as the penning them affordeth one meanes to make, they would hardly haue auoyded being disioynted and rouing ones. Now that I haue done that, my next ayme is that you, vnto whom I wish as much good as to my selfe, may reape as much benefit by the studying it, as I haue done by the composing it. My end then being a priuate one (as looking no further then you my sonne, and my selfe) I haue not endeauoured to expresse my conceptions eyther in the phrase, or in the language of the schooles. It will serue our turne, to comprehend the substance, without confining our selues to any scrupulous exactnesse, in what concerneth onely forme. And the same consideration hath made me passe slightly ouer many particulars, in my first Treatise of the Nature of Bodies; vpon which learned and witty men might spinne out large volumes. For in that part, I ayme no further, then to shew what may be effected by corporeall agents. There, possibility serueth my turne, as well as the determinate indiuisible point of truth. I am obliged to that, onely in my maine great theme; which is the soule. In regard of which, the numerous crooked narrow cranies, and the restrayned flexuous riuolets of corporeall thinges, are all contemptible, further then the knowledge of them serueth to the knowledge of the soule. And a gallant man, whose thoughts flye att the highest game, requireth no further insight into them, then to satisfy himselfe by what way they may be performed;

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and deemeth it farre too meane for him, to dwell vpon the subtileſt of their myſteries for ſcience ſake.

Beſides this liberty that the ſcope I ayme att alloweth me of paſsing very curſorily ouer ſundry particulars; I find now att my reading ouer all together, what I haue written to deliuer it to the Printer, that euen in that which I ought to haue done to comply with my owne deſigne and expectation, I am fallen very short; ſo that if I had not vnwarily too farre engaged my ſelfe for the preſent publishing it, truly I should haue kept it by me, till I had once againe gone ouer it. I find the whole piece very confuſedly done; the ſtile vnequall and vnpolished; many particulars (when they are not abſolutely neceſſary to my maine drift) too ſlightly touched, and farre from being driuen home: and in a word, all of it ſeemeth to be rather but a looſe modell and roughcaſt of what I deſigne to do, then a complete worke throughly finished.

But ſince by my ouerforward promiſing of this piece to ſeuerall frindes, that haue beene very earneſt for it, I haue now brought my ſelfe to that paſſe, that it would ill become me to delay any longer the publishing of ſome thing vpon this ſubiect; and that obligations of an other nature permitt me not att the preſent to dwell any longer vpon this (beſides that, ſo layſy a braine as mine is, groweth ſoone weary when it hath ſo entangled a skeane as this is to vnwind) I now ſend it you as it is; but with a promiſe, that att my firſt leiſure, I will take a ſtrict ſuruey of it; and then in an other edition, will polish, correct and adde what shall appeare needfull to me. If any man shall take the booke out of your hand, inuited by the title and ſubiect to looke into it; I pray you in my behalfe repreſent vnto him, how diſtant my profeſsion is, and how contrary my education hath beene, from writing of bookes. In euery art, the plaineſt that is, there is an apprentiship neceſſary, before it can be expected one should worke in it a fashionable piece. The firſt attemptes are alwayes very imperfect ayminges; and are ſcarce diſcernable what they are meaned for, vnleſſe the maſter guide his ſchollers hand. Much more will the ſame happen in ſo difficult and ſpiny an affaire, as the writing vpon ſuch a nice and copious ſubiect as this is, to one that is ſo wholy ignorant of the lawes of methode as I am.

This free and ingenuous acknowledgement on my ſide, will

I hope

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I hope preuayle with all ingenuous persons, who shall reade what I haue written, to aduertise me fairely (if they iudge it worth their while) of what they dislike in it: to the end that in an other more accurate edition, I may giue them better satisfaction. For besides what faylinges may be in the matter, I can not doubt but that euen in the expressions of it, there must often be great obscurity and shortenesse; which I, who haue my thoughts filled with the thinges themselues, am not aware of. So that, what peraduenture may seeme very full to me, because euery imperfect touch bringeth into my minde the entire notion and whole chaine of circumstances belonging to that thing I haue so often beaten vpon; may appeare very crude and maymed to a stranger, that can not guesse what I would be att, otherwise then as my direct wordes do leade him.

One thing more I shall wish you to desire of them who happily may peruse these two Treatises; aswell for their owne sakes, as for mine. And that is, that they will not passe their censure vpon any particular piece, or broken parcell of eyther of them, taken by it selfe. Lett them draw the entire thridde through their fingers, and lett them examine the consequentnesse of the whole body of the doctrine I deliuer; and lett them compare it by a like suruey with what is ordinarily taught in the schooles: and if they find in theirs, many brackes and short endes which can not be spunne into an euen piece, and in mine, a faire coherence throughout; I shall promise my selfe a fauourable doome from them, and that they will haue an acquiescence in themselues to what I haue here presented them with: whereas, if they but rauell it ouer loosely, and pitch vpon disputing against particular conclusions, that att the first encounter of them single, may seeme harsh vnto them, (which is the ordinary course of flashy wits, who can not fadome the whole extent of a large discourse) it is impossible but that they should be very much vnsatisfyed of me; and goe away with a persuasion, that some such truthes as vpon the whole matter are most euident (one stone in the arch supporting an other, and the whole) are meere chymeras and wilde paradoxes.

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But (Sonne) it is time my booke should speake it selfe, rather then I speake any longer of it here. Reade it carefully ouer, and lett me see by the effects of your gouerning your selfe, that you make such right vse of it, as I may be comforted in hauing chosen you to bequeath it vnto. God in heauen blesse you. Paris the last of August 1644.

Your Louing Father
KENELME DIGBY.

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THE PREFACE.

THIS writing was designed to haue seene the light vnder the name of one treatise. But after it was drawne in paper; as I cast a view ouer it, I found the proœmiall part (which is that which treateth of Bodies) so ample in respect of the other (which was the end of it; and for whose sake I meddled with it) that I readily apprehended my reader would thinke I had gone much astray from my text, when proposing to speake of the immortality of Mans Soule, three parts of foure of the whole discourse, should not so much as in one word mention that soule, whose nature and proprieties I aymed at the discouery of. To auoyde this incongruity, occasioned mee to change the name and vnity of the worke; and to make the suruay of bodies, a body by it selfe: though subordinate to the treatise of the soule. Which notwithstanding it be lesse in bulke then the other; yet I dare promise my Reader, that if he bestow the paines requisite to perfect himselfe in it, he will find as much time well spent in the due reading of it, as in the reading of the former treatise, though farre more large.

But I discerne an obiection obuious to be made; or rather a question; why I should spend so much time in the consideration of bodies, whereas none that hath formerly written of this subiect, hath in any measure done the like. I might answere that they had, vpon other occasions, first written of the nature of bodies: as I may instance in Aristotle; and sundry others, who either haue themselues professedly treated the science of bodies, or haue supposed that part sufficiently performed by other pennes. But truly, I was by an vnauoydable necessity hereunto obliged: which is, a currrent of doctrine that at this day, much raigneth in the Christian Schooles, where bodies and their operations, are explicated after the manner of spirituall thinges. For wee hauing very slender knowledge of spirituall substances, can reach no further into their nature, then to know that they haue certaine

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powers, or qualities; but can ſeldome penetrate ſo deepe, as to deſcend to the particulars of ſuch Qualities, or Powers. Now our moderne Philoſophers haue introduced ſuch a courſe of learning into the ſchooles, that vnto all queſtions concerning the proper natures of bodies, and their operations, it is held ſufficient to anſwere, they haue a quality, or a power to doe ſuch a thing. And afterwards they diſpute whether this Quality or Power, be an Entity diſtinct from its ſubiect, or no; and how it is ſeperable, or vnſeperable from it, and the like. Conformable to this, who will looke into the bookes, which are in vogue in theſe ſchooles, ſhall find ſuch anſwers and ſuch controuerſies euery where, and few others. As, of the ſenſible qualities: aske what it is to be white or red, what to be ſweete or ſower, what to be odoriferous, or ſtincking, what to be cold or hott? And you are preſently paid with, that it is a ſenſible quality, which hath the power to make a wall white or red, to make a meate agreeable or diſagreeable to the taſt, to make a gratefull or vngratefull ſmell to the noſe etc: Likewiſe they make the ſame queſtions and reſolutions, of Grauity and Leuity: as whether they be qualities, that is, entities diſtinct from their ſubiect: and whether they be actiue or paſsiue; which when they haue diſputed ſlightly, and in common, with logicall arguments; they reſt there, without any further ſearching into the phyſicall cauſes or effects of them. The like you ſhall find of all ſtrange effects of them. The loadeſtone and Electricall bodies are produced for miraculous, and not vnderſtandable thinges; and in which, it muſt be acknowledged, that they worke by hidden qualities, that mans witt cannot reach vnto. And aſcending to liuing bodies, they giue it for a Maxime: that life is the action of the ſame Entity vpon it ſelfe: that ſenſe is likewiſe a worke of an intrinſecall power, in the part we call ſenſe, vpon it ſelfe. Which, our predeceſſors held the greateſt abſurdities that could be ſpoken in Philoſophy. Euen ſome Phyſitians, that take vpon them to teach the curing of our bodies, do often pay vs with ſuch termes, among them, you haue long diſcourſes of a retentiue, of an expulſiue, of a purging, of a conſolidating faculty: and ſo of euery thing that eyther paſſeth in our body, or is applied for remedy. And the meaner ſort of Phyſitians know no more, but that ſuch faculties are; though indeed they that are truly Phyſitians, know alſo in what they conſiſt; without

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which knowledge it is much to be feared, Physitians will do more harme then good.

But to returne to our subiect: this course of doctrine in the schooles, hath forced me to a greate deale of paines in seeking to discouer the nature of all such actions (or of the maine part of them) as were famed for incomprehensible: for what hope could I haue, out of the actions of the soule to conuince the nature of it to be incorporeall; if I could giue no other account of bodies operations, then that they were performed by qualities occult, specificall, or incomprehensible? Would not my aduersary presently answere, that any operation, out of which I should presse the soules being spirituall, was performed by a corporeall occult quality: and that as he must acknowledge it to be incomprehensible, so must I likewise acknowledge other qualities of bodies, to be as incomprehensible: and therefore could not with reason presse him, to shew how a body was able to doe such an operation, as I should inferre must of necessity proceede from a spiritt, since that neyther could I giue account how the loadestone drew iron, or looked to the north; how a stone, and other heauy thinges were carried downewardes; how sight or fantasie was made; how digestion or purging were effected; and many other such questions, which are so slightly resolued in the schooles?

Besides this reason, the very desire of knowledge in my selfe; and a willingnesse to be auaylable vnto others (att the least so farre as to sett them on seeking for it, without hauing a preiudice of impossibity in attaining it) was vnto me a sufficient motiue, to enlarge my discourse to the bulke it is risen vnto. For what a misery is it, that the flower and best wittes of Christendome, which flocke to the Vniuersities, vnder pretence and vpon hope of gaining knowledge, should be there deluded; and after many yeares of toyle and expence, be sent home againe, with nothing acquired more then a faculty, and readynesse to talke like parrats of many thinges; but not to vnderstand so much as any one; and withall with a persuasion that in truth nothing can be knowne? For setting knowledge aside, what can it auayle a man to be able to talke of any thing? What are those wranglinges, where the discouery of truth is neyther sought, nor hoped for, but meerely vanity and ostentation? Doth not all tend, to make him seeme and appeare that which indeed he is not? Nor

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lett any body take it ill at my handes, that I ſpeake thus of the moderne ſchooles: for indeed it is rather themſelues then I that ſay it. Excepting Mathematikes, lett all the other ſchooles pronounce their owne mindes, and ſay ingenuouſly, whether they themſelues beleeue they haue ſo much as any one demonſtration, from the beginning to the ending of the whole courſe of their learning. And if all, or the moſt part, will agree that any one poſition is demonſtrated perfectly, and as it ought to be, and as thouſands of concluſions are demonſtrated in Mathematikes; I am ready to vndergoe the blame of hauing calumniated them, and will as readily make them amendes. But if they neither will, nor can; then their owne verdict cleareth me: and it is not ſo much I, as they, that make this profeßion of the ſhallowneſſe of their doctrine. And to this purpoſe I haue often hard the lamentations of diuers, as greate wittes as any that conuerſe in the ſchooles, complaining of this defect. But in ſo greate an euidence of the effect, proofes are ſuperfluous.

Wherefore I will leaue this ſubiect, to declare what I haue here deſigned, and gone about, towardes the remedy of this inconuenience. Which is, that whereas in the ſchooles, there is a looſe methode, or rather none; but that it is lawfull, by the liberty of a commentator, to handle any queſtion, in any place (which is the cauſe of the ſlightneſſe of their doctrine, and can neuer be the way to any ſcience or certitude) I haue taken my beginninges from the commoneſt thinges that are in nature: namely, from the notions of Quantity, and its firſt differences: which are the moſt ſimple, and radicall notions that are, and in which all the reſt are to be grounded. From them I endeauour by immediate compoſition of them, and deriuation from them, to bring downe my diſcourſe to the Elements, which are the primary, and moſt ſimple bodies in nature. From theſe, I proceed to compounded bodies; firſt, to thoſe that are called mixed; and then, to liuing bodies: declaring in common the proprieties and operations that belong vnto them. And by occaſion as I paſſe along, I light here and there on thoſe operations, which ſeeme moſt admirable in nature, to ſhew how they are performed; or att the leaſt, how they may be performed: that though I miſſe in particular of the induſtry of nature, yet I may neuertheleſſe hitt my intent; which is, to trace out a way, how theſe, and ſuch like operations may be effected by an exact diſpoſition, and ordering

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ordering (though intricate) of quantitatiue and corporeall partes: and to shew, that they oblige vs not to recurre vnto hidden and vnexplicable qualities. And if I haue declared so many of these, as may begett a probable persuasion in my reader, that the rest, which I haue not touched, may likewise be displayed, and shewed to spring out of the same groundes, if curious and constant searchers into nature, will make their taske to penetrate into them; I haue therein obtained my desire and intent; which is onely, to shew from what principles, all kindes of corporeall operations do proceed; and what kind of operations all these must be, which may issue out of these principles: to the end, that I may from thence, make a steppe to raise my discourse to the contemplation of the soule; and shew, that her operations are such, as cannot proceed from those principles; which being adequate and common to all bodies, we may rest assured, that what cannot issue from them, cannot haue a body for its source.

I will therefore end this preface, with entreating my reader to consider, that in a discourse proceeding in such order as I haue declared, he must not expect to vnderstand, and be satisfied, with what is said in any middle or later part, vnlesse he first haue read, and vnderstood what goeth before. Wherefore, if he cannot resolue with himselfe, to take it along orderly as it lyeth from the beginning, he shall do himselfe (as well as me) right, not to meddle att all with this booke. But if he will employ any time vpon it, to receiue aduantage by it, he must be content to take the paines to vnderstand throughly euery particular as it is sett downe. And if his memory will not serue him to carry euery one along with him, yet att the least lett him be sure to remember the place where it is handled, and vpon occasion, returne a looke backe vpon it, when it may stand him in steede. If he thinketh this diligence too burthensome, lett him consider that the writing hereof, hath cost the Author much more paines: who as he will esteeme them exceedingly well employed, if they may contribute ought to the content or aduantage of any free and ingenuous mind; so if any others shall expresse a neglect of what he hath with so much labour hewed out of the hard rocke of nature; or shall discourteously cauill att the notions he so freely imparteth vnto them; all the ressentment

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he shall make thereof, will be to desire the first, to consider, that their slight esteeme of his worke, obligeth them to entertaine their thoughts with some more noble and more profittable subiect, and better treated, then this is: and the later sort, to iustifie their dislike of his doctrine, by deliuering a fairer and more complete body of Philosophy, of their owne. Which if hereupon they do, his being the occasion of the ones bettering themselues, and of the others bettering the world, will be the best successe he can wish his booke.

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APPROBATIONES DOCTORVM.

EGo infra ſcriptus natione Anglus, & in ſacra Theologiæ Facultate Pariſienſi Magiſter, fidem facio me librum perlegiſſe Anglicano idiomate ſcriptum; cui titulus, *Two treatiſes, in the one of which the nature of bodies, in the other the nature of mans ſoule is looked into, in way of diſcouerie of the immortalitie of reaſonable ſoules*, Authore nobiliſſimo, & vndequaque eruditiſſimo viro Kenelmo Digbæo Anglo. In quo nihil deprehendi aut fidei, aut pietati Catholicæ, & Romanæ Eccleſiæ diſſonum vel indignum. Quod etiam ſpondeo, priuſquam typis exoluetur, candidiori ac duplicato calculo teſtatum fore. Interea verò ne tantum ſub modio lumen vel parumper deliteſcat, hoc ipſum proprio firmaui chirographo. Datum Pariſiis Kalendis Martij ab Incarnationis anno 1644.

H. HOLDEN.

BY leaue & order from our ſacred Facultie, wee vnder written Doctors of Deuinitie of the Vniuerſitie of Paris haue read ouer this booke, entitled, *Two treatiſes, in the one of which the nature of bodies, in the other the nature of mans ſoule is looked into, in way of diſcouerie of the immortalitie of reaſonable ſoules.* Written by Sir Kenelme Digby, & containing an hundred & ſixteene shites, printed in folio by Gilles Blaizot 1644. Which, as well for its chiefe ſubiects ſake, that neuer ought to be ſlightly handled, as alſo for its new & exotticke aſſertions in matters both of ſoule & bodie, wee haue the more diligently peruſed. And whether it hath hitte or miſſed of the truth, we muſt needs eeſteme & highly extolle the authours manly deſigne to ayme at euidence. Eſpecially in this ſchepticke age, wherein ſo few profeſſe, or thinke it poſsible to know with certitude. Yea wherein euen many of thoſe, who to the vulgar ſeeme Maiſters of learning, acknowledge all philoſophies deciſions only problematicall; and thence labouring to make their voluminous relations of each others phanſies & opinious paſſe for ſcience, haue quite banished her their ſchooles. But here we find a large & lofty ſoule, who not ſatisfyed with vnexamined words & ambiguous termes, longing to know dyues deepely into the bowells of all corporeall & compounded things: and then deuinely ſpeculats the nature of immateriall & ſubſiſtent formes. Nor this by wrangling in aerie names with chimericall imaginations & fained ſuppoſitions of vnknowne qualities, but ſtrongly ſtryuing to diſcloſe the reall & connaturall truth of each thing in it ſelf, and of one

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conſtant & continued thridde, weaues his whole worke into one webbe. Where many of the moſt abſtruſe & enigmaticke queſtions of natures ſecrets, (hitherto vnreſolued, & for the moſt part weakely repreſented in empty language & verball shadowes) are made no leſſe plaine & euident in their inward beings & effects, then pleaſant & gratefull in their wellclothed outſide & expreſsion. In which, though to the blind & common crowde (to whom all thats vnuſuall is a paradox) there may perhapps appeare what they'll dare call extrauagant, and to the midlecyzed gymnaſtickes what they'll conceiue ill grownded, though ingenious queſſes, yet ſurely will the more ſolide reflections of all knowing men begette a liking of its acquaintance. Howſoeuer this wee can & do affirme & teſtifye (although the authour's prodigious parts & publicke credit makes voide our approbation) that nothing contained in either of thoſe two treatiſes, diſcuſsing only the ordinarie courſe of nature, doth any way tende to the diſaduantage of the faith or pietie of our Catholike Roman church, whereof this Authour profeſſeth him ſelfe a dutifull & obedient child. And therefore wee ſigne & ſubſcribe our names here vnto. Paris this 10. of Nouember 1644.

H. HOLDEN. E. TYRREL.

IDEM LATINE.

WEniâ ac iuſſu Sacræ noſtræ Facultatis, Nos infraſcripti S. Theologiæ Doctores Academiæ Pariſienſis, perlegimus librum hunc, cui titulus, *Duo tractatus, in quorum vno natura corporum, altero natura humanæ animæ inſpicitur, ad inueſtigandam animarum rationalium immortalitatem. Authore Kenelmo Digbæo Equite aurato*, centum & ſexdecim ſchedas continentem, typis Ægidij Blaizot in folio excuſum Anno 1644. Quem, tùm ob eius præcipuum ſubiectum, quod nunquam leuiter tractari conuenit, tum maximè ob nouas quaſdam & inuſitatas aſſertiones, tam in animæ quàm corporum materiâ, tanto diligentiori ſtudio peruoluimus. In quo ſiue ipſas veritatis apices adeptus ſit, ſiue non, audaces certè authoris animos, in ipſam euidentiam attentando non poſſumus non magnoperè commendare: in hoc ſceptico præſertim æuo, in quo tam pauci profitentur, aut poſsibile reputant fieri poſſe vt quidquam certò cognoſcatur: imo verò in quo plurimi eorum qui vulgi opinione ſcientiarum magiſtri habentur, quotquot ſunt philoſophiæ poſitiones, non niſi totidem problemata agnoſcunt: quique proinde portentoſis voluminibus ſua aliorumque placita loco veræ ſcientiæ nobis obtrudere volentes, eam prorſus ſcholis ſuis exterminarunt. At hic generoſiorem animum inuenimus, qui nudis hiſce ac inexplicatis voculis haud acquieſcens, ſed veritatis

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ardore ſuccenſus, eam altius in ipſis rerum corporearum viſceribus perſcrutatur: ac tum demum immaterialium & ſubſiſtentium formarum naturam perſpicaciſsimâ mentis acie ſpeculatur. Nec ad hoc contentioſis vtitur verborum rixis, aut chimericas, incognitaſque qualitates in ſubſidium conuocat, ſed genuinam cuiuſque rei, prout in ſe eſt, exhibens veritatem, vnoque, & eo continuo, ſcientiæ filo totum opus contexit. In quo plurima ex abſtruſioribus naturæ ſecretis (quæ hactenus aut omninò non innotuerunt, aut ad ſummum vmbratili verborum fuco ſunt obuoluta) non minus clara & euidentia quoad interiores eorum naturas & effectus, quàm grata & iucunda quoad exteriorem ornatum exhibentur. Inter quæ nonnihil fortaſſe occurret, quod plebeo hominum generi (cui omne inuſitatum paradoxi loco habetur) longè à veritatis ſcopo alienum videri poterit; aut quod moderatioribus gymnaſiaſtis, inualidis quidem innixum fundamentis, attamen non niſi ingenioſis adinuentum coniecturis: Erit nihilominus quod poſt maturam diſcuſſionem, omnium verè doctorum animos ad ſui amorem ac deſiderium alliceat. Quicquid ſit, hoc ſaltem nos poſſumus, ac de facto teſtamur & notum facimus (vtvt Authoris conſpicua fame ac dignitas teſtimonium noſtrum inutile reddat) nihil in vtrolibet horum tractatuum contentum, in quibus ordinarius ſolùm naturæ proceſſus conſideratur, in præiudicium fidei tendere, aut pietatis Catholicæ Romanæ Eccleſiæ, cuius author hic ſe filium obedientiſsimum profitetur. In cuius proinde rei teſtimonium hic noſtra ſubſcripſimus nomina, & ſubſignauimus. Actum Pariſiis 10. Nouembris anno 1644.

H. HOLDEN. E. TYRREL.

ERudita eſt hæc lucubratio, eruditis edita cogitationibus, nihil habet orthodoxis repugnans Maximis, magè maximum magnæ Britanniæ decus loquitur authorem; vere virum, & primis Chriſtiani orbis componendum Heroibus, ea doctrinæ & fortitudinis laude, eo Caſtrenſis & literarij pulueris vſu, iis pro patria & Religione negotiationibus, ea potenti ſuada, tam ſupereminenti politia, tot terra, marique rebus geſtis inclytum, vt eius commentario prælatum Nomen, non modo lucis ipſi vſuram, ſed & quouis terrarum inoffenſo pede commeandi, & iura ciuium vindicandi promereatur. Sic cenſuit Pariſiis in Collegio Pleſſæo 11. Nouembris Anno Domini 1644.

IACOBVS DVLÆVS in ſacra Facultate Pariſ. Doctor Theologus.

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PRÆCLARVM istud Opus, & aureum Viri nobilissimi, illustrissimi Equitis aurati, Domini mei D. Kenelmi Digbæi, non est cur adgrediar approbare vel audeam. Satis illud probatum reddiderint Sapientissimi MM. NN. quibus, me absente, longéque alibi Gentium constituto, hanc prouinciam demandauit sacra nostra Facultas Parisiensis. Iuuat tamen admirari, ac venerari singularem atque præcellentem Viri Genium, parique virtute & fœlicitate Ingenium. Peragrauerat olim Oceanum, mareque Mediterraneum naualibus pugnis, victorijs, triumphis paruâ, sed bene instructâ classiculâ, tot & tam miranda patrauerat, quot, & quanta deinceps alij, ne regijs quidem classibus, sunt assequuti. Martigenam dixisses aut Neptunigenam. Nunc Apollini quóque sacrum se, & charum ostendit; Mineruæ, Musarúmque Alumnum. Principijs quippe subnixus purè naturalibus, paucis quidem, sed validis, bene prouisis, diligenter selectis, ferrea, vt ita dicam, Naturæ claustra perrumpit, atque refringit. Ast quodnam mihi verbum exciderat? aperit leniter potius, & recludit. Sinus, penetralia, recessus, viscera, mentis acumine pererrat: diuitiarum illinc thesauros eruit: vtendos, fruendos nobis elargitur. Principia illius, & elementa, ipsorúmque inter sese texturam & coagmentationem explicat; indeque exorientia mixta, perfecta, imperfecta, viuentia, animata, mouentia, rationis expertia, rationalia; horúmque omnium virtutes, operationes, effectûs: tum, quibus instrumentis ista moliatur Natura Architectrix. Hisce attentâ mente perpensis, & quousque pertingere valeat formarum, quæ plane sunt materiales, vis & potestas; tum demùm clara luce visendum ostendit, Formam nostram, non animam duntaxat esse, quâ sumus, vegetamur, mouemur, sentimus, sed & animum, mentemque, quâ sapimus, & intelligimus: Hac nos præterita reminiscendo recolere; præsentia supra ipsa reflectendo intueri; futura, non ex aëris humorúmve immutatione, sed ratiocinando, & verâ prouidentiâ, in alteram quoque ætatem, & sæcula prospicere, & præcauere: Quin & eumdem animum, cum cætera permeauerit intelligibilia

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ligibilia, reuocatâ in se suâ atque subductâ ratiocinatione, eam supra semetipsam conuertere, ac retorquere: ac verè suam omnem ènergiam tunc exerere & studiosissimè exercere; quî sese eumdem testetur manifestè & intelligentem esse, & intelligibile. Assequi istud non posse Agentia, omnimodis à materia dependentia. Hinc ipsum euinci spiritualem, & immortalém esse, & sine corpore potentem subsistere. Abstractæ propterea statum, vim, virtutem, functiones, operationes persequitur accuratè, & assequitur; quantum fieri potest in sublustribus & opacis terrenæ commorationis nostræ vmbraculis. At ô bone Deus! Dum campos & lata mentis prætoria perlustrat, abstrusioraque voluntatis liberrimæ receptacula; abditosque grandis memoriæ recessûs, & quæ reponuntur illic miris tamquam cellis & caueis; quam inde miranda nobis egerit, quam stupenda producit? Res illîc esse innumerabiles, quarum sonos verborum & nominum, tenuesue, languidas, emortuas per sensum hauserimus vmbras & imagines; viuidas autem & veraces intus nos habere earum notiones atque rationes; illius etiam quo quid est, quidquid est, siue, vt more nostro loquar, essentiarum ab omni materia depuratarum, definitiones, diuisiones, quæque ex illis sequuntur demonstrationes. Nostrum nos timorem sine timore recolere, nostramque tristes lætitiam; vitam nos beatam prælibare, & purum ab omni fœce gaudium, quod in vno hominum nemine sumus experti. Ad imitationem summi, post Apostolorum tempora, ingenio & doctrinâ Theologi, exclamare libet: Quale tibi fabricatus es cubile in mente mea Domine? Quale tibi sanctuarium ædificasti? Quid ego nunc styli nitorem, & vbertatem deprædicem? Exemplorum, similitudinum, experimentorum copiam & varietatem? Scientiarum omnium vnica in dissertatione breuiarium & anacephalœosim? Hisce, Vir natalitijs, ingenio, doctrinâ summus, riuulis, floribus, luminibus ita irrigauit, conuestiuit, distinxit, læta reddidit horrida, vt videbantur arua & aspera contemplationis Physicæ, vt certare possint cum lætissimis, & amœnissimis hortis aliorum, & suburbanis. Gratulor magnæ Britanniæ, quondam fœcundæ maximorum ingeniorum parenti, & altrici; quæ ne hoc quidem æuo senectute caduco, aut phrœnisi laborante, sese indicat sterilem & effœ-

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tum. Gratulor linguæ Anglicanæ, locupletissimæ iam antea, & suauissimæ; cuius t men pomœria longè latéque protulit Author hic splendidissimus. Gratulor Philologis & Philosophis Anglis, quibus viam præiuit, quâ se quoque possint vulgo eximere, atque in libertatem asserere; & horridiuscula quæque & inculta nitidissimè edisserere. Gratulor denique generosissimo beatæ prolis parenti, tam altam animi pacem, tranquillitatem, magnitudinem; vt inter nouercantis fortunæ procellas, bellorum tumultûs, aulæ strepitûs, ista tamen procudere valuerit.

H. MAILLARD.

THE

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THE FIRST TREATISE DECLARING THE NATVRE AND OPERATIONS OF BODIES.

THE FIRST CHAPTER.

A Preamble to the whole discourse; concerning notions in generall.

IN deliuering any science; the cleereſt and ſmootheſt methode, and moſt agreeable to nature; is to begin with the conſideration of thoſe thinges, that are moſt common and obuious; and by the diſſection of them to deſcend by orderly degrees and ſteppes (as they lye in the way) vnto the examination of the moſt particular and remote ones. Now, in our preſent intended ſuruay of a body, the firſt thing which occurreth to our ſenſe in the peruſall of it, is its *Quantity*, bulke, or magnitude: and this ſeemeth by all mankind, to be conceiued ſo inſeparable from a body as when a man would diſtinguish a corporeall ſubſtance from a ſpirituall one (wich is accounted indiuiſible) he naturally pitcheth vpon an apprehenſion of its hauing bulke, and beind ſolide, tangible, and apt to make impreſſion vpon our outward ſenſes; according to that expreſſion of Lucretius, vvho ſtudying nature in a familiar and rationall manner telleth vs;

1. *Quantity* is the firſt, and moſt obuious affection of a body.

Tangere enim & tangi, niſi corpus nulla poteſt res.

And therefore in our inquiry of bodies, we will obſerue that plaine methode which nature teacheth vs, and will begin with examining *what Quantity is*, as being their firſt and primary affection; and that which maketh the thinges we treate of, be what we intend to ſignify by the name of body.

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2. Wordes do not expreſſe thinges as they are in themſelues, but onely as they are painted in the mindes of men.

But becauſe there is a greate variety of apprehenſions framed by learned men, of the nature of *Quantity* (though indeede nothing can be more plaine and ſimple then it is in it ſelfe) I conceiue it will not be amiſſe, before we enter into the explication of it, to conſider how the myſtery of diſcourſing and expreſſing our thoughts to one an other by words (a prerogatiue belonging only to man) is ordered and gouerned among vs: that ſo, we may auoyde thoſe rockes, which many, and for the moſt part, ſuch as thinke they ſpinne the fineſt thriddes, do ſuffer shippewracke againſt in theire ſubtileſt diſcourſes. The moſt dangerous of all which, aſſuredly is when they confound the true and reall natures of thinges, with the conceptions they frame of them in theire owne mindes. By which fundamentall miſcarriage of theire reaſoning, they fall into great errors and abſurdities: and whatſoeuer they build vpon ſo ruinous a foundation, prooueth but vſeleſſe cobwebbes or prodigious Chymeras. It is true, wordes ſerue to expreſſe thinges: but if you obſerue the matter well; you will perceiue they doe ſo, onely according to the pictures we make of them in our owne thoughts, and not according as the thinges are in theire proper natures. Which is very reaſonable it ſhould be ſo; ſince the ſoule, that giueth the names, hath nothing of the thinges in her but theſe notions, and knoweth not the thinges otherwiſe then by theſe notions: and therefore can not giue other names but ſuch as muſt ſignify the thinges by mediation of theſe notions. In the thinges, all that belongeth vnto them is compriſed vnder one entire Entity: but in vs, there are framed as many ſeuerall diſtinct formall conceptions, as that one thing sheweth it ſelfe vnto vs with differét faces. Euery one of which conceptions ſeemeth to haue for its obiect a diſtinct thing, becauſe the conception it ſelfe is as much ſeuered and diſtinguiſhed from another conception or image, ariſing out of the very ſame thing that begott this, as it can be from any image painted in the vnderſtanding by an abſolutely other thing.

3. The firſt error that may ariſe fromhence; which is a multiplying of things, where no ſuch multiplication is really found.

It will not be amiſſe to illuſtrate this matter by ſome familiar example. Imagine I haue an apple in my hand: the ſame fruite worketh different effects vpon my ſeuerall ſenſes: my eye telleth me it is greene or red: my noſe that it hath a mellow ſent: my taſte that it is ſweet, and my hand that it is cold and weighty. My ſenſes thus affected, ſend meſſengers to my fantaſie with newes of the diſcoueries they haue made: and there, all of them make ſeuerall and diſtinct pictures of what entereth by theire dores. So that my Reaſon (which diſcourſeth vpon what it findeth in my fantaſie) can conſider greeneneſſe by it ſelfe, or mellowneſſe, or ſweeteneſſe, or coldneſſe, or any other quality whatſoeuer, ſingly and alone by it ſelfe, without relation to any other that is painted in me by the ſame apple: in which, none of theſe haue any diſtinction at all, but are one and the ſame ſubſtance of the apple, that maketh various and different impreſſions

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preſſions vpon me, according to the various diſpoſitions of my ſeuerall ſenſes: as hereafter we shall explicate at large. But in my mind, euery one of theſe notions is a diſtinct picture by it ſelfe, and is as much ſeuered from any of the reſt ariſing from the ſame apple, as it would be from any impreſſion or image made in me, by a ſtone or any other ſubſtance whatſoeuer, that being entire in it ſelfe and circumſcribed within its owne circle, is abſolutely ſequeſtred from any communication with the other: ſo that, what is but one entire thing in it ſelfe, ſeemeth to be many diſtinct thinges in my vnderſtanding. Whereby, if I be not very cautious, and in a manner wreſtle with the bent and inclination of my vnderſtanding (which is apt to referre the diſtinct and complete ſtampe it findeth within it ſelfe, vnto a diſtinct and complete originall character in the thing) I shall be in danger before I am aware, to giue actuall Beings to the quantity, figure, colour, ſmell, taſt, and other accidents of the apple, each of them diſtinct one from an other, as alſo from the ſubſtance which they clothe; becauſe I find the notions of them really diſtinguished (as if they were different Entities) in my minde. And from thence I may inferre, there is noe contradiction in nature to haue the accidents really ſeuered from one an other, and to haue them actually ſubſiſt without theire ſubſtance: and ſuch other miſtaken ſubtilities; which ariſe out of our vnwary conceiting that thinges are in theire owne natures, after the ſame fashion as we conſider them in our vnderſtanding.

4. A ſecond error; the conceiuing of many diſtinct thinges as really one thing.

And this courſe of the mindes diſguiſing and changing the impreſſions it receiueth from outward obiects, into appearances quite differing from what the thinges are in theire owne reall natures; may be obſerued not only in multiplying Entities, where in truth there is but one: But alſo in a contrary manner, by compriſing ſeuerall diſtinct thinges, vnder one ſingle notion; which if afterwards it be reflected backe vpon the thinges themſelues, is the occaſion of exceeding great errours, and entangleth one in vnſuperable difficulties. As for example: looking vpon ſeuerall cubes or deyes, whereof one is of gold, an other of lead, a third of yuory, a fourth of wood, a fifth of glaſſe and what other matter you pleaſe; all theſe ſeuerall thinges agree together in my vnderſtanding, and are there comprehended vnder one ſingle notion of a cube; which (like a painter that were to deſigne them onely in blacke and white) maketh one figure that repreſenteth them all. Now if remooving my conſideration from this impreſſion which the ſeuerall cubes make in my vnderſtanding, vnto the cubes themſelues, I shall vnwarily ſuffer my ſelfe to pinne this one notion vpon euery one of them, and accordingly conceiue it to be really in them; it will of neceſſity fall out by this misapplying of my intellectuall notion to the reall thinges, that I muſt allow Exiſtence to other entities, which neuer had nor can haue any in nature.

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From this conception, Platos Idæas had theire birth; for he finding in his vnderſtanding, one vniuerſall notion that agreed exactly to euery Indiuiduall of the ſame ſpecies of ſubſtance, which imprinted that notion in him; and conceiuing that the picture of any thing muſt haue an exact correſpondence with the thing it repreſenteth; and not conſidering that this was but an imperfect picture of the indiuiduall that made it: he did thence conceiue, there was actually in euery indiuiduall ſubſtance one vniverſall nature running through all of that ſpecies, which made them be what they were. And then conſidering that corporeity, quantity, and other accidents of matter, could not agree with this vniuerſall ſubſiſtent nature, he denyed all thoſe of it: and ſo, abſtracting from all materiality in his Idæas, and giuing them a reall and actuall ſubſiſtence in nature, he made them like Angels, whoſe eſſences and formall reaſons were to be the Eſſence and to giue Exiſtence vnto corporeall indiuiduals: and ſo, each idæa was embodyed in euery indiuiduall of its ſpecies. Vnto which opinion (and vpon the ſame groundes) Auerroes did leane, in the particular of mens ſoules. Likewiſe, Scotus finding in his vnderſtanding an vniuerſall notion ſpringing from the impreſſion that indiuiduals make in it, will, haue a like vniuerſall in the thing it ſelfe, ſo determining vniuerſals (to vſe his owne language and termes) to be *a parte rei*; and expreſſing the diſtinction they haue from the reſt of the thing, by the termes of *actu formaliter ſed non realiter*: and therby maketh euery indiuiduall compriſe an vniuerſall ſubſiſtent nature in it. Which inconuenience other moderne Philoſophers ſeeking to auoyde, will not allow theſe vniuerſals a reall and actuall ſubſiſtence; but will lend them onely a fictitious Being, ſo making them as they call them *Entia rationis*. But herein againe they ſuffer themſelues to be carried downe the ſtreame before they are aware by the vnderſtanding (which is apt to pinne vpon the obiects, the notions it findeth within it ſelfe reſulting from them) and doe conſider an vnity in the thinges which indeede is onely in the vnderſtanding.

5. Great care to be taken to auoyde the errors, which may ariſe from our manner of vnderſtanding thinges.

Therefore one of our greateſt cares in the guidance of our diſcourſe, and a continual and ſedulous caution therein, ought to be vſed in this particular, where euery error is a fundamentall one, and leadeth into inextricable labyrinthes, and where that which is all our leuell to keepe vs vpright and euen (our vnderſtanding) is ſo apt, by reaſon of its owne nature, and manner of operation to make vs ſlide into miſtaking and errour. And to ſumme vp in short what this diſcourſe aymeth att, we muſt narrowly take heed, leaſt reflecting vpon the notions we haue in our mind, we afterwards pinne thoſe ayery ſuperſtructures vpon the materiall thinges themſelues, that begott them; or frame a new conception of the nature of any thing by the negotiation of our vnderſtanding vpon thoſe impreſſions which it ſelfe maketh in vs: whereas, we ſhould acquieſce and be content with

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with that naturall and plaine notion, which ſpringeth immediately and primarily from the thing it ſelfe: which when we do not, the more we ſeeme to excell in ſubtility, the further we goe from reality and truth; like an arrow, which being wrong leuelled at hand, falleth wideſt when shott in the ſtrongeſt bowe.

6. Two ſorts of wordes to expreſſe our notions; the one common to all men, the other proper to ſchollers.

Now to come to an other poynt that maketh to our preſent purpoſe. We may obſerue there are two ſorts of language to expreſſe our notions by. The one belongeth in generall to all mankind, and the ſimpleſt perſon, that can but apprehend and ſpeake ſenſe, is as much iudge of it, as the greateſt Doctour in the ſchooles: and in this, the words expreſſe the thinges properly and plainely, according to the naturall conceptions that all people agree in making of them. The other ſort of language, is circled in with narrower boundes; and is vnderſtood onely by thoſe that in a particular and expreſſe manner haue beene trayned vp vnto it: and many of the wordes which are proper to it, haue beene by the authors of it, tranſlated and wreſted from the generall conceptions of the ſame wordes, by ſome metaphore, or ſimilitude, or alluſion, to ſerue theire priuate turnes. Without the firſt manner of expreſſing our notions, mankind could not liue in ſociety together, and conuerſe with one an other: whereas, the other hath no further extent, then among ſuch perſons as haue agreed together to explicate and deſigne among themſelues particular notions peculiar to theire arts and affaires.

Of the firſt kind, are thoſe tenne generall heads, which Ariſtotle calleth Prædicaments: vnder which he (who was the moſt iudicious orderer of notions, and directour of mens cõceptions that euer liued) hath cõpriſed whatſoeuer hath, or can haue a being in nature. For when any obiect occurreth to our thoughts, we eyther conſider the eſſentiall and fundamentall Being of it; or we referre it to ſome ſpecies of Quantity; or we diſcouer ſome qualities in it; or we perceiue that it doeth, or that it ſuffereth ſome thing; or we conceiue it in ſome determinate place, or time, and the like. Of all which, euery man liuing that enioyeth but the vſe of reaſon, findeth naturally within himſelfe at the very firſt naming of them, a plaine, complete, and ſatisfying notion; which is the ſame without any the leaſt variation, in all mankind; vnleſſe it be in ſuch, as haue induſtriouſly and by force, and with much labour, perplexed and depraued thoſe primary and ſincere impreſſions, which nature had freely made in them.

Of the ſecond ſort, are the particular wordes of art by which learned men vſe to expreſſe what they meane in ſciences; and the names of inſtruments, and of ſuch thinges as belong to trades, and the like: as a ſine, a tangent, an epicycle, a deferent, an axe, a trowell, and ſuch others; the intelligence of which, belongeth not to the generality of mankind; but onely to Geometricians, Aſtronomers, Carpenters, Maſons, and ſuch perſons as conuerſe familiarly and fre-

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quently with thoſe thinges. To learne the true ſignification of ſuch wordes, we muſt conſult with thoſe that haue the knowledge and practiſe of them: as in like manner, to vnderſtand the other kind of plaine language, we muſt obſerue how the wordes that compoſe it are apprehended, vſed, and applyed by mankind in generall: and not receiue into this examination the wreſted or Metaphoricall ſenſes of any learned men, who ſeeke oftentimes (beyond any ground in nature) to frame a generall notion that may comprehend all the particular ones, which in any ſenſe, proper or improper, may ariſe out of the vſe of one word.

7. Great errors ariſe by wreſting wordes from theire common meaning to expreſſe a more particular or ſtudied notion.

And this is the cauſe of greate errors in diſcourſe; ſoe greate and important, as I cannot too much inculcate the caution requiſite to the auoyding of this rocke. Which that it may be the better apprehended, I will inſtance in one example of a moſt plaine and eaſie conception wherein all mankind naturally agreeth, how the wreſting it from its proper, genuine, and originall ſignification, leadeth one into ſtrange abſurdities; and yet they paſſe for ſubtile ſpeculations. The notion of being in a place, is naturally the ſame in all men liuing: aske any ſimple artiſan; Where ſuch a man, ſuch a howſe, ſuch a tree, or ſuch a thing is; and he will anſwere you in the very ſame manner as the learnedeſt Philoſopher would doe: he will tell you, the man you aske for, is in ſuch a church, ſitting in ſuch a piew, and in ſuch a corner of it; that the howſe you enquire after, is in ſuch a ſtreete, and next to ſuch two buildinges on each ſide of it; that the tree you would find out, is in ſuch a foreſt, vpon ſuch a hill, neere ſuch a fountaine, and by ſuch a bush; that the wine you would drinke of, is in ſuch a cellar, in ſuch a part of it, and in ſuch a caske. In concluſion, no man liuing that ſpeaketh naturally and freely out of the notion hee findeth clearely in his vnderſtanding, will giue you other anſwere to the queſtion *of where a thing is*, then ſuch a one as plainely expreſſeth his conceit of being in place, to be no other, then a bodies being enuironed and encloſed by ſome one, or ſeuerall others that are immediate vnto it; as the place, of a liquor, is the veſſell that containeth it; and the place of the veſſell, is ſuch a part of the chamber, or houſe that it reſteth vpon, together with the ambient ayre; which hath a share in making vp the places of moſt thinges. And this being the anſwere, that euery man whatſoeuer will readily giue to this queſtion; and euery asker being fully ſatisfied with it; we may ſafely conclude, that all theire notions and conceptions of being in a place, are the ſame; and conſequently, that it is the naturall and true one.

But then ſome others, conſidering that ſuch conditions as theſe will not agree vnto other thinges, which they likewiſe conceite to be in a place (for they receiue it as an Axiome from theire ſenſe, that whatſoeuer is, muſt be ſomewhere, and whatſoeuer is no where, is not att all) they fall to caſting about how they may frame ſome common

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common notion to comprehend all the ſeuerall kindes of being in place, which they imagine in the thinges they diſcourſe of. If there were nothing but bodies to be ranked by them in the Predicament of place; then that deſcription I haue already ſett downe, would be allowed by them, as ſufficient. But ſince that ſpirits and ſpirituall thinges, (as Angels, rationall ſoules, verities, ſciencies, arts, and the like) haue a being in nature; and yet will not be compriſed in ſuch a kind of place as a body is contained in; they racke theire thoughts to ſpeculate out ſome common notion of being in place, which may be common to theſe, as well as to bodies; like a common accident agreeing to diuerſe ſubiects. And ſo in the end, they pitch vpon an Entity, which they call an Vbi: and they conceite the nature and formall reaſon of that to be, the ranking of any thing in a place, when that Entity is therevnto affixed. And then they haue no further difficulty, in ſettling an Angell or any pure ſpirit, or immateriall eſſence, in a place as properly, and as completely, as if it were a corporeall ſubſtance. It is but aſſigning an Vbi to ſuch a ſpirit, and he is preſently riueted to what place you pleaſe: and by multiplying the Vbies, any indiuiduall body vnto which they are aſſigned, is at the ſame inſtant in as many diſtant places, as they allott it different Vbies: and if they aſſigne the ſame Vbi to ſeuerall bodies, ſo many ſeuerall ones as they aſſigne it vnto, will be in one and the ſame place: and not onely many bodies in one place, but euen a whole bodie in an indiuiſible, by a kind of Vbi that hath a power to reſume all the extended partes, and encloſe them in a point of place. All which prodigious conceits and impoſſibilities in nature, doe ſpring out of theire miſtake in framing Metaphyſicall and abſtracted conceptions, inſteed of contenting themſelues with thoſe plaine, eaſy, and primary notions, which nature ſtampeth a like in all men of common ſenſe, and vnderſtanding. As who deſireth to bee further inſtructed in this particular, may perceiue, if he take the paines to looke ouer what M. White hath diſcourſed of *Place* in the firſt of his Dialogues *De Mundo*. Vnto which booke, I shall from time to time (according as I shall haue occaſion) referre my Reader in thoſe ſubiects the Author taketh vppon him to prooue; being confident that his Metaphyſicall demonſtrations there, are as firme, as any Mathematicall ones (for Metaphyſicall demonſtrations haue in themſelues as much firmeneſſe, certainty and euidency as they) and ſo will appeare as euident, as they, vnto whoſoeuer shall vnderſtand them throughly, and shall frame right conceptions of them: which (how plaine ſoeuer they ſeeme to bee) is not the worke of euery pretender to learning.

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THE SECOND CHAPTER.

Of Quantity.

1. Wee must know the vulgar and common notion of Quantity that wee may vnderstand the nature of it.

AMONG those primary affections which occurre in the perusall of a body, *Quantity* (as I haue obserued in the precedent chapter) is one and in a manner the first and the roote of all the rest. Therefore (according to the caution we haue beene so prolixe in giuing, because it is of so maine importance) if we ayme at right vnderstanding the true nature of it, we must examine, what apprehension all kindes of people (that is mankind in generall) maketh of it. By which proceeding, we doe not make the ignorant multitude iudge of that learning which groweth out of the consideration of Quantity: but onely of the naturall notion which serueth learned men for a basis and foundation to build scientificall superstructures vpon. For although, sciencies be the workes and structures of the vnderstanding gouerned and leuelled by the wary and strict rules of most ingenious artificers: yet the ground vpon which they are raised, are such plaine notions of thinges, as naturally and without any art doe present themselues to euery mans apprehension: without which for matter to worke vpon, those artificiall reflections would leaue the vnderstanding as vnsatisfied; as a cooke would the appetite, by a dish vpon which he should haue exercised all his art in dressing it, but whose first substance were not meate of solide nutriment. It is the course market that must deliuer him plaine materialls to employ his cunning vpon: and in like manner, it is the indisciplined multitude that must furnish learned men with naturall apprehensions, and notions to exercise theire wittes about: which when they haue, they may vse and order ad reflect vpon them as they please: but they must first receiue them in that plaine and naked forme, as mankind in generall pictureth them out in theire imaginations.

And therefore the first worke of schollers, is to learne of the people

Quem penes, arbitrium est & ius & norma loquendi,

what is the true meaning and signification of these primary names, and what notions they begett in the generality of mankinde of the thinges they designe. Of the common people then, we must enquire *what Quantity is*: and we shall soone be informed, if we but consider what answere any sensible man will make vpon the soddaine to a question whereof that is the subiect: for, such vnstudyed replies expresse sincerely the plaine and naturall conceptions, which they that make them, haue of the thinges they speake of. And this of Quantity, is the plainest and the first, that nature printeth in vs, of all the thinges we see, feele, and conuerse with all; and that must serue for a ground

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vnto all our other inquiries and reflections: for which cauſe, we muſt be ſure not to receiue it wreſted or diguiſed from its owne nature.

2. Extenſion or diuiſibility is the common notion of Quantity.

If then any one be asked; what Quantity there is in ſuch a thing, or how greate it is; he will preſently in his vnderſtanding compare it with ſome other thing, (equally knowne by both parties) that may ſerue for a meaſure vnto it; and then anſwere, that it is as bigge as it, or twiçe as bigge, or not halfe ſo bigge, or the like: in fine, that it is bigger or leſſer then an other thing, or equall to it.

It is of maine importance to haue this point throughly and clearely vnderſtood; therefore it will not be amiſſe to turne it and veiw it a little more particularly. If you aske what Quantity there is, of ſuch a parcell of cloth, how much wood in ſuch a piece of timber, how much gold in ſuch an ingott, how much wine in ſuch a veſſell, how much time was taken vp in ſuch an action; he that is to giue you an account of them, meaſureth them by elles, by feete, by inches, by poundes, by ounces, by gallons, by pintes, by daies, by houres, and the like; and then telleth you, how many of thoſe parts, are in the whole that you enquire of. Which anſwere, euery man liuing will at the inſtant, without ſtudy, make to this queſtion; and with it, euery man that shall aske, will be fully appayed and ſatisfyed: ſo that it is moſt euident, it fully expreſſeth the notions of them both, and of all mankind, in this particular.

Wherefore, when we conſider that Quantity is nothing elſe, but the extenſion of a thing; and that this extenſion, is expreſſed by a determinate number of leſſer extenſions of the ſame nature; (which leſſer ones, are ſooner and more eaſily apprehended then greater; becauſe we are firſt acquainted and conuerſant with ſuch; and our vnderſtanding graſpeth, weigheth and diſcerneth ſuch more ſteadily; and maketh an exacter iudgement of them) and that ſuch leſſer ones are in the greater which they meaſure, as partes in a whole; and that the whole by comprehending thoſe partes, is a meere capacity to be diuided into them: we conclude, that *Quantity or Biggneſſe*, is nothing elſe but diuiſibility; and that a thing is bigge, by hauing a capacity to be diuided, or (which is the ſame) to haue partes made of it.

This is yet more euident (if more may be) in Diſcrete Quantity (that is, in *number*) then in continued Quantity, or extenſion. For if we conſider any number whatſoeuer, we shall find the eſſence of it, conſiſteth in a capacity of being reſolued and diuided into ſo many vnities, as are contained in it; which are the partes of it. And this ſpecies of Quantity being ſimpler, then the other, ſerueth for a rule to determine it by: as we may obſerue in the familiar anſweres to queſtions of continued Quantity, which expreſſe by number, the content of it: as when one deliuereth the Quantity of a piece of ground, by ſuch a number of furlonges, acars, perches, or the like.

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3. Partes of Quantity are not actually in theire whole.

But we muſt take heed of conceiuing, that thoſe partes, which we conſider to diſcerne the nature of Quantity, are actually and really in the *whole* of any continued one that containeth them. Elles, feete, inches, are no more reall Entities in the *whole* that is meaſured by them, and that maketh impreſſions of ſuch notions in our vnderſtanding; then in our former example, colour, figure mellowneſſe, taſt, and the like are ſeuerall ſubſtances in the apple that affecteth our ſeuerall ſenſes with ſuch various impreſſions. It is but one *whole* that may indeed be cutt into ſo many ſeuerall partes: but thoſe partes are not really there, till by diuiſion they are parcelled out: and then, the whole (out of which they are made) ceaſeth to be any longer; and the partes ſucceede in lieu of it; and are, euery one of them, a new *whole*.

This truth, is euident out of the very definition we haue gathered of Quantity. For ſince it is *Diuiſibility* (that is, a bare capacity to diuiſion) it followeth that it is not yet diuided: and conſequently that thoſe partes are not yet in it, which may be made of it; for diuiſion, is the making two, or more thinges, of one.

4. If partes were actually in theire whole, Quãtity would bee compoſed of indiuiſibles.

But becauſe this is a very greate controuerſy in ſchooles; and ſo important to be determined and ſettled, as without doing ſo, we shall be lyable to maine errors in ſearching the nature and operations of bodies; and that the whole progreſſe of our diſcourſe, will be vncertaine and wauering, if this principle and foundation be not firmely layed: we muſt apply our ſelues, to bring ſome more particular and immediate proofe of the verity of this aſſertion. Which we will do, by shewing the inconuenience, impoſſibility, and contradiction, that the admittance of the other leadeth vnto. For if we allow actuall partes to be diſtinguished in Quantity, it will follow that it is compoſed of points or indiuiſibles, which we shall prooue to be impoſſible.

The firſt will appeare thus: if Quantity were diuided into all the partes into which it is diuiſible, it would be diuided into indiuiſibles (for nothing diuiſible, and not diuided, would remaine in it) but it is diſtinguished into the ſame partes, into which it would be diuided, if it were diuided into all the partes into which it is diuiſible; therefore it is diſtinguished into indiuiſibles. The maior propoſition is euident to any man that hath eyes of vnderſtanding. The minor, is the confeſſion or rather the poſition of the aduerſary, when he ſayth that all its partes are actually diſtinguished. The conſequence cannot be calumniated, ſince that indiuiſibles, whether they be ſeperated or ioyned, are ſtill but indiuiſibles; though that which is compoſed of them be diuiſible. It muſt then be granted that all the partes which are in Quantity, are indiuiſibles; which partes being actually in it, and the whole being compoſed af theſe partes onely, it followeth, that Quantity is compoſed and made of indiuiſibles.

If any should cauill at the ſuppoſition, and ſay we ſtretch it further then

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then they intend it, by taking *all* the partes to be distinguished; whereas they meane onely that there are partes actually in Quantity, abstracting from *all*: by reason that *all*, in this matter would inferre an infinity, which to be actually in any created thing, they will allow to be impossible. Our answere will be, to represent vnto them how this is barely said, without any ground or colour of reason, meerely to euade the inconuenience, that the argument driueth them vnto. For if any partes be actually distinguished, why should not all be so? What prerogatiue haue some that the others haue not? And how came they by it? If they haue theire actuall distinction out of theire nature of being partes, then all must enioy it a like, and all be equally distinguished, as the supposition goeth: and they must all be indiuisibles as we haue prooued. Besides to preuent the cauill vpon the word *all*, we may change the expression of the Proposition into a negatiue: for if they admitt (as they doe) that there is no part in Quantity, but is distinguished as farre as it may be distinguished, then the same conclusion followeth with no lesse euidence; and all will prooue indiuisibles, as before.

5. Quantity cannot be composed of indiuisibles.

But it is impossible that indiuisibles should make Quantity; for if they should, it must be done eyther by a finite and determinate number, or by an infinite multitude of them. If you say by a finite; lett vs take (for example) three indiuisibles, and by adding them together, lett vs suppose a line to be composed; whose extent being onely longitude, it is the first and simplest species of Quantity, and therefore whatsoeuer is diuisible into partes, must be at the least a line. This line thus made, cannot be conceiued to be diuided into more partes then into three; since doing so you reduce it, into the indiuisibles that composed it. But Euclide hath demonstratiuely prooued beyond all cauill, (in the tenth proposition of his sixt booke of Elements) that any line whatsoeuer may be diuided into whatsoeuer number of partes; so that if this be a line, it must be diuisible into a hundred or a thousand, or a million of partes: which being impossible in a line, that being diuided into three partes onely, euery one of those three is incapable of further diuision; it is euident, that neyther a line, nor any Quantity whatsoeuer, is composed or made of a determinate number of indiuisibles.

And since that this capacity of being diuisible into infinite partes, is a property belonging to all extension (for Euclides demonstration is vniuersall) wee must needes confesse that it is the nature of indiuisibles, when they are ioyned together, to be drowned in one another, for otherwyse there would result a kind of extension out of them, which would not haue that property; contrary to what Euclide hath demonstrated. And fromhence it followeth that Quantity cannot be composed of an infinite multitude of such indiuisibles; for if this be the nature of indiuisibles, though you putt neuer so greate a number

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of them together, they will ſtill drowne themſelues all in one indiuiſible point. For what difference can theire being infinite, bring to them, of ſuch force as to deſtroy theire eſſence and property? If you but conſider how the eſſentiall compoſition of any multitude whatſoeuer, is made by the continuall addition of vnities, till that number ariſe; it is euident in our caſe that the infinity of indiuiſibles muſt alſo ariſe, out of the continued addition of ſtill one indiuiſible to the indiuiſibles preſuppoſed: then lett vs apprehend a finite number of indiuiſibles, which (according as we haue prooued) do make no extenſion, but are all of them drowned in the firſt; and obſeruing how the progreſſe vnto an infinite multitude, goeth on by the ſteppes of one and one, added ſtill to this preſuppoſed number; we ſhall ſee, that euery indiuiſible added and conſequently the whole infinity, will be drowned in the firſt number, as that was in the firſt indiuiſible.

Which will be yet plainer, if we conſider that the nature of extenſion requireth that one parte be not in the ſame place, where the other is: then if this extenſion be compoſed of indiuiſibles, lett vs take two pointes of place in which this extenſion is, and inquire whether the indiuiſibles that are in each one of theſe pointes, be finite or infinite. If it be anſwered that they are finite, then the finite indiuiſibles in thoſe two pointes make an extenſion; which we haue prooued impoſſible. But if they be ſaid to be infinite; then infinite indiuiſibles are drowned in one point, and conſequently haue not the force to make extenſion. Thus then it remaineth firmely eſtabliſhed, *That Quantity is not compoſed of indiuiſibles* (neyther finite, nor infinite ones) and conſequently, *that partes are not actually in it.*

6. An obiection to prooue that partes are actually in Quantity; with a declaration of the miſtake from whence it procedeth.

Yet before we leaue this point, although we haue already beene ſomewhat long about it, I conceiue it will not be tedious, if we be yet a litle longer, and bend our diſcourſe to remooue a difficulty that euen ſenſe it ſelfe ſeemeth to obiect vnto vs. For doth not our eye euidently informe vs, there are fingers, handes, armes, legges, feete, toes and variety of other partes, in a mans body? Theſe are actually in him, and ſeeme to be diſtinct thinges in him, ſo euidently, that we cannot be perſuaded, but that we ſee, and feele, the diſtinction betweene them: for euery one of them, hath a particular power of actuall working and doing what belongeth vntoits nature to do: each finger is really there; the hand is different from the foote; the legge from the arme; and ſo of the reſt. Are not theſe partes then actually and really in a mans body? And is not each of them as really diſtinguished from any other?

This appeareth at the firſt ſight to be an inſuperable obiection, becauſe of the confirmation and euidence that ſenſe ſeemeth to giue it. But looking neerely into the matter, we ſhall find that the difficulty ariſeth not from what ſenſe informeth vs of; but from our wrong applying the conditions of our notions vnto the thinges that make impreſſions

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impreſſions vpon our ſenſe. Senſe iudgeth not which is a finger, which is a hand, or which is a foote. The notions agreeing to theſe wordes, as well as the wordes themſelues, are productions of the vnderſtanding: which conſidering ſeuerall impreſſions made vpon the ſenſe by the ſame thing as it hath a vertue, and power to ſeuerall operations, frameth ſeuerall notions of it: as in our former example, it doth of colour, figure, taſt and the like, in an apple. For as theſe are not different bodies or ſubſtances, diſtinguished one from an other; but are the ſame one entire thing, working ſeuerally vpon the ſenſes, and that accordingly, maketh theſe different pictures in the mind; which are there as much diſtinguished, as if they were pictures of different ſubſtances. So, the partes which are conſidered in Quantity, are not diuerſe thinges: but are onely a vertue or power to be diuers thinges: which vertue, making ſeuerall impreſſions vpon the ſenſes, occaſioneth ſeuerall notions in the vnderſtanding: and the vnderſtanding is ſo much the more prone to conceiue thoſe partes as diſtinct thinges, by how much Quantity is neerer to be diſtinct thinges, then the qualities of the apple are. For Quantity, is a poſſibility to be made diſtinct thinges by diuiſion: whereas the others, are but a vertue to do diſtinct thinges. And yet (as we haue touched aboue) nothing can be more manifeſt, then that if Quantity be diuiſibility (which is a poſſibility, that many thinges may be made of it) theſe partes are not yet diuers thinges. So that, if (for example) a rodde be layed before vs, and halfe of it be hid from our ſight, and the other halfe appeare; it is not one part or thing that sheweth it ſelfe, and an other part or thing that doth not shew it ſelfe: but it is the ſame rodde or thing, which sheweth it ſelfe according to the poſſibility of being one new thing, but doth not shew it ſelfe according to the poſſibility of being the other of the two thinges, it may be made by diuiſion. Which example, if it be well conſidered will make it much more eaſily ſinke into vs, that a hand, or eye, or foote, is not a diſtinct thing by it ſelfe; but that it is the man, according as he hath a certaine vertue or power in him to diſtinct operations. For if you ſeuer any of theſe partes from the whole body; the hand can no more hold; nor the eye ſee; nor the foote walke; which are the powers that eſſentially conſtitute them to be what they are: and therefore they are no longer a hand, an eye, or a foote.

7. The ſolution of the former obiection: and that ſenſe cannot diſcerne whether one part be diſtinguished from another, or no.

Now then to come to the obiection; lett vs examine how farre, ſenſe may be allowed to be iudge in this difficulty: and we shall find, that ſenſe cannot determine any one part in a body: for if it could, it would preciſely tell, where that part beginneth or endeth: but it being agreed vpon, that it beginneth and endeth in indiuiſibles; it is certaine, that ſenſe cannot determine of them. If then ſenſe cannot determine any one part, how shall it ſee that it is diſtinguished from all other partes? Againe; conſidering that all that whereof ſenſe is capable,

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is diuiſible, it ſtill telleth vs, that in all it ſeeth, there are more partes then one: and therefore it can not diſcerne, nor informe vs of any that is one alone: nor knoweth what it is to be one; for it neuer could diſcerne it: but what is many, is many *ones* and can not be knowne, by that, which knoweth not, what it is to be one: and conſequently ſenſe can not telle vs, that there are many. Wherefore it is euident, that we may not rely vpon ſenſe for this queſtion. And as for reaſon, she hath already giuen her verdict.

So that nothing remaineth but to shew, why we talke as we do, in ordinary diſcourſe, of many partes: and that what we ſay in that kind, is true, notwithſtanding the vnity of the thing. Which will appeare plainely, if we conſider that our vnderſtanding hath a cuſtome for the better diſcerning of thinges, to impoſe vpon a thing as it is vnder one notion, the excluſion of it ſelf as it is vnder other notions. And this is euident vnto all ſchollers, when the marke of excluſion is expreſſely putt: as when they ſpeake of a white thing, adding the reduplication, *as it is white*? which excludeth all other conſiderations of that thing, beſides the whiteneſſe of it: but when it cometh vnder ſome particular name of the thing, it may deceiue thoſe that are not cunning: though indeede, moſt men diſcouer it in ſuch names as we call abſtracted; as humanity, animality, and the like. But it eaſily deceiueth when it cometh in concrete names; as it doth in the name of *Part* in generall, or in the names of particular partes; as a hand, an eye, an inch, an elle, and others of the like nature: for as you ſee that a part excludeth both the notion of the whole, and of the remaining partes: ſo doth a hand, an eye, an elle, exclude all the reſt of that thing, whereof the hand is a hand, and the elle is an elle, and ſo forth. Now then, as euery man ſeeth euidently that it can not be ſaid; the wall as it is white is plaſter or ſtone: no more can it be ſaid, that the hand of a man is a foote; becauſe the word *hand* ſignifieth as much in it ſelfe, as if the man were taken, by reduplication, to be the man as he is hand, or as he hath the power of holding. So likewiſe, in the rodde we ſpoke of before; it can not be ſaid that the part ſeene is the part vnſeene; becauſe the part ſeene, ſignifieth the rodde as it is a poſſibility to be made by diuiſion ſuch a thing, as it appeareth to the ſight. And thus it is cleare how the difficulty of this point, ariſeth out of the wrongfull applying the conditions of our notions, and of names, to the obiects and thinges which we know: where of we gaue warning in the begining.

Chap. 1. §. 2. 3.

8. An enumeration of the ſeuerall ſpecieſes of Quantity, which confirmeth that the eſſence of it is diuiſibility.

After which there remaineth no more to be ſaid of this ſubiect, but to enumerate the ſeuerall ſpecieſes of Quantity, according to that diuiſion which Logitians for more facility of diſcourſe haue made of it. Namely, theſe ſixe: magnitudine, place, motion, time, number, and weight. Of which, the two firſt are permanent, and lye ſtill expoſed to the pleaſure of whoſoeuer hath a mind to take a ſuruay of them.

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Which he may do by measuring what partes they are diuisible into; how many elles, feete, inches, a thing is long broad or deepe; how great a place is; whether it be not bigger or lesser then such an other; and by such considerations as these; which do all agree in this, that they expresse the essence of those two species of Quantity, to consist in a capacity of being diuided into partes.

The two next; motion and time; though they be of a fleeting propriety, yet it is euident that in regard of theire originall and essentiall nature, they are nothing else but a like diuisibility into partes; which is measured by passing ouer so great or so litle distance; and by yeares, dayes, houres, minutes, and the like. Number we also see is of the same nature; for it is diuisible into so many determinate partes, and is measured by vnities, or by lesser numbers so or so often contained in a proposed greater. And the like is euident of weight, which is diuisible into poundes, ounces, drammes, or graines; and by them is measured. So that looking ouer all the seuerall species of Quantity; it is euident, our definition of it is a true one, and expresseth fully the essence of it, when we say it is *diuisibility*, or a capacity to be diuided into partes: and that no other notion whatsoeuer, besides this, reacheth the nature of it.

THE THIRD CHAPTER.

Of Rarity and Density.

I INTEND in this Chapter to looke as farre as I can into the nature and causes of the two first differences of bodies, which follow out of Quantity as it concurreth with substance to make a body: for, the discouery of them, and of the various proportions of them among themselues, will be a great and important steppe in the iourney we are going. But the scarcity of our language is such, in subiets remooued from ordinary conuersation, (though in others, I thinke none is more copious or expressiue) as affordeth vs not apt wordes of our owne to expresse significantly such notions as I must busie my selfe about in this discourse. Therefore I will presume to borrow them from the Latine schoole, where there is much adoe about them. I would expresse the difference betweene bodies, that vnder the same measures and outward bulke, haue a greater thinnesse and expansion, or thickenesse and solidity, one then an other; which termes, (or any I can find in English) do not signify fully those affections of Quantity that I intend here to declare: therefore I will do it vnder the names of Rarity and Density; the true meaning of which will appeare by what we shall hereafter say.

1. What is meant by Rarity and Density.

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2. It is euident that ſome bodies are rare and others denſe; though obſure, how they are ſuch.

It is euident vnto vs, that there are different ſortes of bodies, of which though you take equall quantities in one regard, yet they will be vnequall in an other. Theire magnitudes may be the ſame, but theire weights will be different; or contrariwiſe, theire weights being equall, theire outward meaſures will not be ſo. Take a pinte of ayre; and weigh it againſt a pinte of water, and you will ſee the ballance of the laſt goe downe amaine: but if you driue out the ayre by filling the pinte with lead, the other pinte in which the water is, will riſe againe as faſt: which if you poure out, and fill that pinte with quickeſiluer, you will perceaue the lead to be much lighter: and againe, you will find a pinte of gold heauier then ſo much Mercury. And in like manner, if you take away of the heauy bodies till they agree in weight with the lighter, they will take vp and fill different proportions, and partes of the meaſure that shall containe them.

But from whence this effect ariſeth, is the difficulty that we would lay open. Our meaſures tell vs theire quantities are equall; and reaſon aſſureth vs, there can not be two bodies in one and the ſame place; therefore when we ſee that a pinte of one thing outweigheth a pinte of an other that is thinner, we muſt conclude that there is more body compacted together in the heauy thing then in the light: for elſe how could ſo litle of a ſolide or denſe thing, be ſtretched out, to take vp ſo great roome, as we ſee in a baſen of water that being rarifyed into ſmoake or ayre, filleth a whole chamber? and againe, shrinke backe into ſo litle roome, as when it returneth into water, or is contracted into yce? But how this comprehenſion of more body in equall roome is effected, doth not a litle trouble Philoſophers.

3. A breife enumeration of the ſeuerall properties belonging to rare and denſe bodies.

To find a way that may carry vs through theſe difficulties that ariſe out of the Rarity and Denſity of bodies, lett vs do as Aſtronomers when they enquire the motions of the Spheres and Planets: they take all the Phenomena or ſeuerall appearances of them to our eyes; and then attribute to them ſuch orbes, courſes, and periodes, as may ſquare and fitt with euery one of them; and by ſuppoſing them, they can exactly calculate all that will euer after happen to them in theire motions. So lett vs take into our conſideration the cheife properties of rare and denſe bodies, and then caſt with our ſelues to find out an hypotheſis, or ſuppoſition (if it be poſſible) that may agree with them all.

Firſt, it ſeemeth vnto vs that denſe bodies haue theire partes more cloſe and compacted, then others haue, that are more rare and ſubtile. Secondly they are more heauy, then rare ones. Againe, the rare are more eaſily diuided then the denſe bodies: for water, oyle, milke, honey, and ſuch like ſubſtances will not onely yield eaſily to any harder thing that shall make its way through them; but they are ſo apt to diuiſion and to looſe theire continuity, that theire owne weights will ouercome and breake it: whereas in iron, gold, marble,

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and ſuch denſe bodies, a much greater weight and force, is neceſſary to worke that effect. And indeed if wee looke well into it, we shall find that the rarer thinges, are as diuiſible in a leſſer Quantity, as the more denſe are in a greater: and the ſame force will breake the rarer thing into more and leſſer partes, then it will an equall one that is more denſe. Take a ſticke of light wood of ſuch a biggeneſſe that being a foote long, you may breake it with your handes, and an other of the ſame biggeneſſe, but of a more heauy and compacted wood, and you shall not breake it, though it be two foote long: and with equall force you may breake a loafe of bread into more and leſſe partes, then a lumpe of lead that is of the ſame biggeneſſe. Which alſo will reſiſt more to the diuiſion of fire (the ſubtileſt diuider that is) then ſo much water will; for the litle atomes of fire (which we shall diſcourſe of hereafter) will pierce and cutt out in the water, almoſt as litle partes as themſelues, and mingling themſelues with them they will fly away together, and ſo conuert the whole body of water into ſubtile ſmoake: whereas the ſame Agent, after long working vpon lead, will bring it into no leſſe partes then ſmall graines of duſt, which it calcineth it into. And gold, that is more denſe then lead, reſiſteth peremptorily all the diuiding power of fire; and will not at all be reduced into a calx or lime by ſuch operation as reduced lead into it.

So that remembring, how the nature of Quantity is Diuiſibility; and conſidering that rare thinges are more diuiſible then denſe ones; we muſt needes acknowledge that the nature of Quantity is ſome way more perfectly in thinges that are rare, then in thoſe that are denſe. On the other ſide, more compacted and denſe thinges, may happily ſeeme to ſome to haue more Quantity then thoſe that are rare; and that it is but shruncke together; which may be ſtretched out and driuen into much greater dimenſions then the Quantity of rare thinges, taking the quantities of each of them equall in outward appearance. As gold may be beaten into much more and thinner leafe, then an equall bulke of ſyluer or lead. A waxe candle will burne longer with equall light, then a tallow candle of the ſame biggeneſſe; and conſequently, be conuerted into a greater Quantity of fire and ayre. Oyle will make much more flame then ſpiritt of wine, that is farre rarer then it.

4. The opinion of thoſe Philoſophers declared, who putt rarity to conſiſt in an actuall diuiſion of a body into litle partes.

Theſe and ſuch like conſiderations, haue much perplexed Philoſophers, and haue driuen them into diuerſe thoughts to find out the reaſons of them. Some obſeruing that the diuiding of a body into litle partes, maketh it leſſe apt to deſcend, then when it is in greater; haue beleeued the whole cauſe of litghneſſe and rarity to be deriued from diuiſion. As for example; they find that lead cutt into litle pieces, will not goe downe ſo faſt in water, as when it is in bulke: and it may be reduced into ſo ſmall atomes, that it will for ſome ſpace ſwimme vpon the water like duſt of wood.

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Which assumption is prooued by the greate Galileus; vnto whose excellent witt and admirable industry, the world is beholding, not onely for his wonderfull discoueries made in the heauens, but also for his accurate and learned declaring of those very thinges that lye vnder our feete. He, about the 90th page of his first Dialogue of motion, doth clearly demonstrate how any reall medium must of necessity resist more the descent of a litle piece of lead, or any other weighty matter, then it would a greater piece: and the resistence will be greater and greater as the pieces are lesser and lesser. So that, as the pieces are made lesse, they will in the same medium sinke the slower; and do seeme to haue acquired a new nature of lightnesse by theire diminution: not onely of hauing lesse weight in them then they had; as halfe an ounce is lesse then a whole ounce: but also of hauing in themselues a lesse proportion of weight to theire bulke then they had; as a pound of corke, is in regard of its magnitude lighter then a pound of lead: so as they conclude, that the thing whose continued partes are the lesser, is in its owne nature the lighter and the rarer; and other thinges whose continued partes are greater, they be heauier and denser.

5. The former opinion reiected, and the ground of theire error discouered.

But this discourse reacheth not home: for by it, the weight of any body being discouered by the proportion it hath to the medium, in which it descendeth, it must euer suppose a body lighter then it selfe in which it may sinke and goe to the bottome. Now of that lighter body, I enquire what maketh it be so; and you must answere by what you haue concluded, that it is lighter then the other, because the partes of it are lesse, and more seuered from one an other: for if they be as close together, theire diuision auayleth them nothing, since thinges sticking fast together, do worke as if they were but one, and so a pound of lead though it be filed into small dust, if it be compacted hard together, will sinke as fast as if it were in one bulke.

Now then allowing the litle partes to be seperated, I aske, what other body filleth vp the spaces betweene those litle partes of the medium in which your heauy body descended? For if the partes of water are more seuered then the partes of lead, there must be some other substance to keepe the partes of it a sunder: lett vs suppose this to be ayre: and I aske, whether an equall part of ayre, be as heauy as so much water? or whether it be not? If you say, it is; then the compound of water and ayre, must be as heauy as lead; seeing that theire partes, one with an other, are as much compacted as the partes of lead are. For there is no difference whether those bodies, whose litle partes are compacted together be of the same substance, or of diuers, or whether the one be diuided into smaller partes then the other, or no, (so they be of equall weights) in regard of making the whole equally heauy: as you may experience, if you mingle pinne dust with a sand of equall weight, though it be beaten into farre smaller

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diuiſions then the pinneduſt, and putt them in a bagge together.

But if you ſay that ayre is not ſo heauy as water; it muſt be, becauſe euery part of ayre hath againe its partes more ſeuered by ſome other body, then the partes of water are ſeuered by ayre. And then, I make the ſame inſtance of that body which ſeuereth the partes of ayre. And ſo, att the laſt (ſince there can not actually be an infinite proceſſe of bodies one lighter then an other) you muſt come to one, whoſe litle partes filling the pores and ſpaces between the partes of the others, haue no ſpaces in themſelues to be filled vp.

But as ſoone as you acknowledge ſuch a body tobe lighter and rarer then all the reſt, you contradict and deſtroy all you ſaid before. For by reaſon of its hauing no pores, it followeth by your rule, that the litle partes of it muſt be as heauy, if not heauier, then the litle partes of the ſame bigneſſe of that body whoſe pores it filleth; and conſequently it is proued by the experience we alleadged of pinneduſt mingled with ſand that the litle partes of it, can not by theire mingling with the partes of the body in which it is immediately contained, make that lighter then it would be if theſe litle partes were not mingled with it. Nor would both theire partes mingled with the body which immediately containeth them, make that body lighter. And ſo proceeding on in the ſame ſort through all the mingled bodies, till you come to the laſt, that is immediately mingled with water; you will make water nothing the lighter, for being mingled with all theſe; and by conſequence it should be as heauy and as denſe as lead.

Now that which deceiued the authors of this opiniion, was that they had not a right intelligence of the cauſes which made litle partes of bodies (naturally heauy) deſcend ſlowly, in regard of the velocity of greater partes of the ſame bodies deſcending: the doctrine of which we intend to deliuer hereafter.

6. The opinion of thoſe Philoſophers related, who putt rarity to conſiſt in the mixtion of vacuity among bodies.

Others therefore perceiuing this rule to fall short, haue endeauoured to piece it out by the mixtion of vacuity among bodies; belieuing it is that which maketh one rarer then an other. Which mixtion they do not putt alwayes immediate to the maine body they conſider: but if it haue other rarer and lighter bodies mingled with it, they conceiue this mixtion immediate onely to the rareſt, or lighteſt. As for example; a cryſtall being lighter and conſequently rarer then a diamond, they will not ſay that there is more vacuity in a cryſtall then in a diamond; but that the pores of a cryſtall are greater, and that conſequently there is more ayre in a cryſtall to fill the pores of it, then is in a diamond; and the vacuities are in the ayre, which abounding in a cryſtall, more then in a diamond, maketh that lighter and rarer then this, by the more vacuities that are in the greater Quantity of ayre which is migled with it.

But againſt this ſuppoſition, a powerfull aduerſary is vrged: for Ariſtotle, in his 4th booke of Phyſickes, hath demonſtrated that

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there can be no motion in vacuity. It is true, they endeauour to euade his demonſtration (as not reaching home to theire ſuppoſition) by acknowledging it to be an euident one in ſuch a vacuity as he there ſpeaketh of; which he ſuppoſed to be ſo great a one that a body may ſwimme in it as in an ocean, and not touch or be neere any other body: whereas this opinion excludeth all ſuch vaſt inanity, and admitteth no vacuities but ſo litle ones as no body whatſoeuer can come vnto but will be bigger then they; and conſequently, muſt on ſome ſide or other touch the corporeall partes which thoſe vacuities diuide; for they are the ſeperations of the leaſt partes, that are, or can be, actually diuided from one an other: which partes, muſt of neceſſity touch one an other on ſome ſide; or elſe, they could not hang together to compoſe one ſubſtance; and therefore, the diuiding vacuities, muſt be leſſe then the diuided partes. And thus, no body will euer be in danger of floating vp and downe without touching any thing: which is the difficulty that Ariſtotle chiefely impugneth.

7. The opinion of vacuities refuted.

I confeſſe I should be very glad that this ſuppoſition might ſerue our turne, and ſaue the Phœnomena that appeare among bodies, through theire variety of Rarity and Denſity: which if it might be, then would I ſtraight go on to the inquiring after what followed out of this ground, as Aſtronomers (to vſe our former ſimilitude) do calculate the future appearances of the celeſtiall bodies out of thoſe motions and orbes they aſſigne vnto the heauens. For as this apprehenſion of vacuity in bodies is very eaſy and intelligibile: ſo the other (which I conceiue to be the truth of the caſe) is exceedingly abſtracted, and one of the moſt difficult pointes in all the Metaphyſickes: and therefore I would (if it were poſſible) auoyde touching vpon it in this diſcourſe, which I deſire should be as plaine and eaſy, and as much remooued from ſcholaſticke termes, as may be.

But indeed, the inconueniences that follow out of this ſuppoſition of vacuities, are ſo great, as it is impoſſible by any meanes to ſlide them ouer. As for example; lett vs borrow of Galilæus the proportion of weight betweene water and ayre. He sheweth vs how the one is 400 times heauyer then the other. And Marinus Ghetaldus teacheth vs that gold is 19 times heauyer then water: ſo that gold muſt be 7600 times heauyer then ayre. Now then conſidering that nothing in a body can weigh, but the ſolide partes of it; it followeth that the proportion of the partes of gold in a ſphere of an inch diameter, is to the partes of ayre of a like dimenſion as 7600 is to one. Therefore in ayre it ſelfe the vacuities that are ſuppoſed in it, will be to the ſolide partes of it in the ſame proportion as 7600 to one. Indeed, the proportion of difference will be greater: for euen in gold many vacuities muſt be admitted, as appeareth by the heating of it which sheweth that in euery the leaſt part, it is exceeding porous. But according to this rate, without preſſing the inconuenience any further; the ayre will

Dialog. 1. del *Mouim. pag.* 81.

Archimed. Promot.

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by this reckoning appeare to be like a nett, whose holes and distances, are to the lines and thriddes, in the proportion of 7600 to one; and so, would be lyable to haue litle partes of its body swimme in those greater vacuities; contrary to what they striue to auoyde. Which would be exceedingly more, if we found on the one side any bodies heauyer and denser then gold, and that were so solide as to exclude all vacuities; and on the other side should ballance them with such bodies as are lighter and rarer then ayre; as fire is; and as some will haue the *æther* to be. But already the disproportion is so great, and the vacuity so strangely exceedeth the body in which it is, as were too great an absurdity to be admitted.

And besides, it would destroy all motion of small bodies in the ayre, if it be true (as Aristotle hath demonstrated in the 4th booke of his Physickes) that motion can not be made, but among bodies, and not *in vacuo*.

Againe, if rarity were made by vacuity, rare bodies could not be gathered together; without loosing theire rarity and becoming dense. The contrary of which, we learne by constant experience; as when the smith and glassemender, driue theire white and fury fires, (as they terme them;) when ayre pierceth most in the sharpe wind; and generally we see that more of the same kind of rare bodies, in lesse place, worketh most efficaciously according to the nature that resulteth out of that degree of rarity. Which argueth, that euery litle part is as rare as it was before (for else it would loose the vertue of working according to that nature;) but that by theire being crowded together, they exclude all other bodies that before did mediate betweene the litle partes of theire maine body; and so, more partes being gotten together in the same place then formerly there were, they worke more forcibly.

Thirdly; if such vacuities were the cause of rarity; it would follow that fluide bodies being rarer then solide ones, they would be of themselues standing, like nettes or cobbewebbes: whereas contrariwise, we see theire natures are to runne together, and to fill vp euery litle creeke and corner: which effect, following out of the very nature of the thinges themselues; must needes exclude vacuities out of that nature.

And lastly; if it be true (as we haue shewed in the last Chapter) that there are no actuall partes in Quantity; it followeth of necessity, that all Quantity must of it selfe be one; as Metaphysickes teach vs: and then, no distance can be admitted betweene one Quantity and an other.

And truly, if I vnderstand Aristotle right; he hath perfectly demonstrated, that no vacuity is possible in nature; neither great nor litle: and consequently, the whole machine raysed vpon that supposition, must be ruinous. His argument is to this purpose. What is

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nothing, can not haue partes: but vacuum is nothing (becauſe as the aduerſaries conceiue it, vacuum is the want of a corporeall ſubſtance in an encloſing body, within whoſe ſides nothing is, whereas a certaine body might be contained whithin them, as if in a paile or bowle of a gallon, there were neither milke, nor water, nor ayre, nor any other body whatſoeuer) therefore, vacuum can not haue partes. Yet thoſe who admitt it do putt it expreſſely for a ſpace; which doth eſſentially include partes. And thus they putt two contradictories, nothing and partes, that is, partes, and no partes; or ſomething and nothing; in the ſame propoſition. And this, I conceiue to be abſolutely vnauoydable.

8. Rarity and Déſity conſiſt in the ſeuerall proportions, which Quantity hath to its ſubſtance.

For theſe reaſons therefore, I muſt entreate my readers fauour, that he will allow me to touch vpon metaphyſickes a litle more then I deſire or intended: but it shall be no otherwiſe, then as is ſaid, of the dogges by the riuer Nilus ſide; who being thirſty, lappe haſtily of the water, onely to ſerue theire neceſſity as they runne along the shore. Thus then; remembring how wee determined that Quantity is Diuiſibility: it followeth, that if beſides Quantity there be a ſubſtance or thing which is diuiſible; that thing, if it be condiſtinguished from its Quantity or Diuiſibility, muſt of it ſelfe be indiuiſible: or (to ſpeake more properly) it muſt be, not diuiſible. Putt then ſuch ſubſtance to be capable of the Quantity of the whole world or vniuerſe: and conſequently, you putt it of it ſelfe indifferent to all, and to any part of Quantity: for in it, by reaſon of the negation of Diuiſibility, there is no variety of partes, whereof one should be the ſubiect of one part of Quantity, or another of another; or that one should be a capacity of more, another of leſſe.

This then being ſo, wee haue the ground of more or leſſe proportion between ſubſtance and quantity: for if the whole quantity of the vniuerſe bee putt into it, the proportion of Quantity to the capacity of that ſubſtance, will bee greater then if but halfe that quantity were imbibed in the ſame ſubſtance. And becauſe proportion changeth on both ſides by the ſingle change of onely one ſide: it followeth that in the latter, the proportion of that ſubſtance to its Quantity, is greater; and that in the former, it is leſſe; howbeit the ſubſtance in it ſelfe be indiuiſible.

What wee haue ſaid thus in abſtract, will ſinke more eaſily into vs if we apply it to ſome particular bodies here among vs, in which we ſee a difference of Rarity and Denſity; as to ayre, water gold, or the like; and examine if the effects that happen to them, do follow out of this diſproportion betweene ſubſtance and Quantity. For example lett vs conceiue that all the Quantity of the world were in one vniforme ſubſtance, then the whole vniuerſe would be in one and the ſame degree of Rarity ad Denſity: lett that degree, be the degree of water; it will then follow, that in what part ſoeuer there happeneth to be

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to be a change from this degree, that part will not haue that proportion of quantity to its ſubſtance, which the quantity of the whole world had to the preſuppoſed vniforme ſubſtance. But if it happeneth to haue the degree of rarity which is in the ayre, it will then haue more quantity in proportion to its ſubſtance, then would be due vnto it according to the preſuppoſed proportion of the quantity of the vniuerſe to the foreſaid vniforme ſubſtance; which in this caſe is as it were the ſtandard to try all other proportions by. And contrariwiſe, if it happeneth to haue the degree of Denſity which is found in Earth or in gold; then it will haue leſſe quantity in proportion to its ſubſtance, then would be due vnto it according to the foreſaid proportion, or common ſtandard.

Now to proceede from hence, with examining the effects which reſult out of this compounding of Quantity with ſubſtance, we may firſt conſider, that the definitions which Ariſtotle hath giuen vs of Rarity and Denſity, are the ſame wee driue att: hee telleth vs, that that body is rare whoſe quantity is more, and its ſubſtance leſſe; that, contrariwiſe denſe, where the ſubſtance is more and the quantity leſſe. Now if wee looke into the proprieties of the bodies wee haue named, or of any others, wee shall ſee them all follow cleerely out of theſe definitions. For firſt, that one is more diffuſed, an other more compacted; ſuch diffuſion and compaction, ſeeme to be the very natures of Rarity and Denſity, ſuppoſing them to be ſuch as we haue defined them to be; ſeeing that, ſubſtance is more diffuſed by hauing more partes, or by being in more partes; and is more compacted by the contrary. And then, that rare bodies are more diuiſible then denſe ones, you ſee is coincident into the ſame conceit with their diffuſion and compaction. And fromhence againe it followeth, that they are more eaſily diuided in great, and likewiſe, that they are by the force of naturall Agents diuiſible into leſſer partes: for both theſe (that is facility of being diuided, and eaſye diuiſibility into leſſer partes) are contained in being more diuiſible; or in more enioying the effect of quantity, which is diuiſibility. From this againe followeth, that in rare bodies there is leſſe reſiſtance to the motion of an other body through it, then in denſe ones; and therefore a like force paſſeth more eaſily through the one, then through the other. Againe; rare bodies are more penetratiue and actiue then denſe ones; becauſe being (by theire ouerproportion of quantity) eaſily diuiſible into ſmall partes, they can runne into euery litle pore, and ſo incorporate themſelues better into other bodies, then more denſe ones can. Light bodies likewiſe muſt be rarer, becauſe moſt diuiſible, if other circumſtances concurre equally.

Thus you ſee decyphered vnto your hand, the firſt diuiſion of bodies flowing from Quantity as it is ordained to ſubſtance for the compoſition of a bodie: for ſince the definition of a body is; *A thing*

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which hath partes; and quantity is that, *by which it hath partes;* and the first propriety of quantity is, *to be bigger or lesse*; and consequently the first differences of haueing partes, are to haue bigger or lesse, more or fewer; what diuision of a body can be more simple, more plaine, or more immediate, then to diuide it by its *Quantity* as making it to haue bigger or lesse, more or fewer partes in proportion to its substance?

Neithet can I iustly be blamed for touching thus on Metaphysickes, to explicate the nature of these two kindes of bodies; for Metaphysickes being the science aboue Physickes, it belongeth vnto her to declare the principles of Physickes: of which, these wee haue now in hand, are the very first steppe. But much more, if wee consider that the composition of quantity with substance, is purely Metaphysicall; wee must necessarily allow the inquiry into the nature of Rarity and Density, to be wholy Metaphysicall; seeing that the essence of Rarity and Density, standeth in the proportion of quantity to substance; if we beleeue Aristotle, (the greatest master that euer was, of finding out definitions and notions) and trust to the vncontroulable reasons we haue brought in the precedent discourse.

9. All must admitt in Physicall bodies, a Metaphysicall composition.

This explication of Rarity and Density, by the composition of substance with quantity, may peraduenture giue litle satisfaction vnto such as are not vsed to raise theire thoughts aboue Physicall and naturall speculations: who are apt to conceiue, there is no other composition or resolution, but such as our senses shew vs in compounding and diuiding of bodies according to quantatiue partes. Now this obligeth vs to shew that such a kind of composition and diuision as this, must necessarily be allowed of, euen in that course of doctrine which seemes most contrary to ours. To which purpose, lett vs suppose that the position of Democritus or of Epicurus is true; to witt, that the originall composition of all bodies, is out of very litle ones of various figures; all of them, indiuisible, not Mathematically, but Physically: and that this infinite number of indiuisibles, doth floate in an immense ocean of vacuum or imaginary space. In this position, lett any man who conceiueth theire groundes may be maintained, explicate how one of these litle bodies is mooued. For, taking two partes of vacuum, in which this body successiuely is; it is cleare, that really, and not onely in my vnderstanding, it is a difference in the said body, to be now here, now there: wherefore, when the body is gone thither, the notion of being here, is no more in the body; and consequently, is diuided from the body. And therefore, when the body was here; there was a composition, betweene the body, and its being here: which, seeing it can not be betwixt two partes of Quantity, must of necessity be such a kind of composition, as wee putt betweene quantity and substance. And certainely, lett men wracke theire braines neuer so much, they will neuer be able to shew how motion is made, without some such composition and diuision, vpon what groundes soeuer they proceede.

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And if then they tell vs, that they vnderſtand not how there can be a diuiſibility betweene ſubſtance and quantity; wee may reply, that to ſuch a diuiſibility two thinges are required; firſt that the notions of ſubſtance and quantity be different; ſecondly, that the one of them may be changed without the other. As for the firſt, it is moſt euident wee make an abſolute diſtinction betweene theire two notions; both, when wee ſay that Socrates was bigger a man then a boy; and when wee conceiue that milke or water whiles it boyleth, or wine whiles it worketh, ſo as they runne ouer the veſſels they are in; are greater and poſſeſſe more place then when they were coole and quiet, and filled not the veſſell to the brimme. For howſoeuer, witty explications may ſeeme to euade, that the ſame thing is now greater, now leſſer; yett it can not be auoyded, but that ordinary men, who looke not into Phyloſophy, do both conceiue it to be ſo, and in theire familiar diſcourſe expreſſe it ſo; which they could not do, if they had not different notions of the ſubſtance, and of the quantity of the thing they ſpeake of. And though wee had no ſuch euidences, the very names and definitions of them would putt it beyond ſtrife: all men calling ſubſtance, a thing; quantity, biggeneſſe: and referring a thing, to *Being*; as who would ſay; that which is: but biggeneſſe, to ſome other of like nature, vnto which it is compared; as, that it is halfe as bigge, twice as bigge, or the like.

This then being vnauoydable, that the notions are diſtinguished; there remaineth no difficulty, but onely in the ſecond, namely that the one may be changed, and the other not. Which reaſon and demonſtration do conuince, as wee haue shewed. Wherefore, if any shall yett further reply, that they do not vnderſtand how ſuch change is made; wee shall anſwere, by asking them whether they know; how the change of being ſometimes here, ſometimes there is made by locall motion in vacuum, without a change in the body mooued. Which queſtion, if they can not ſatisfy; they muſt eyther deny that there is any locall motion in vacuum; or elſe admitt a change in quantity, without a change in ſubſtance; for this latter is as euidently true, as they ſuppoſe the former to be; though the manner how they are effected, be alike obſcure in both, and the reaſon of the obſcurity, the ſame in both.

With which wee will conclude the preſent Chapter; adding onely this note. That if all Phyſicall thinges and naturall changes do proceede out of the conſtitution of rare and denſe bodies in this manner, as we do putt them, (as the worke wee haue in hand intendeth to shew) then, ſo manifold effects will ſo conuince the truth of this doctrine which wee haue declared, that there can remaine no doubt of it: neither can there be any, of the diuiſibility of quantity from ſubſtance; without which, this doctrine can not conſiſt. For it can not be vnderſtood, how there is a greater proportion of quantity then of

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ſubſtance; or contrariwiſe, of ſubſtance then of quantity; if there be not a reall diuiſibility betweene quantity and ſubſtance. And much leſſe can it be conceiued, that the ſame thing hath att one time a greater proportion of quantity, and att an other time a leſſe; if the greater or leſſer proportion, be not ſeperable from it; that is, if there be not a diuiſibility betwixt it and ſubſtance, as well as there are different notions of them. Which to prooue by the proper principles belonging to this matter, would require vs to make a greater inroade into the very bowels of Metaphyſickes, and to take a larger circuite, then is fitting eyther for the ſubiect, or for the intended breuity of this treatiſe.

THE FOVRTH CHAPTER.

Of the foure firſt qualities: and of the foure Elements.

I. The notions of denſity and rarity haue a latitude capable of infinite variety.

THE ſubiect of our diſcourſe hitherto, hath been three ſimple notions; Quantity, Rarity, and Denſity. Now it shall be to inquire if by compounding theſe with grauity or weight (which is one of the ſpecieſes of Quantity aboue mentioned and of which I shall ſpeake at lardge hereafter) wee may begett any further qualities, and ſo produce the foure firſt bodies, called Elements. In imitation of Logitians, who by compounding ſuch propoſitions as of themſelues are euident to mans nature aſſoone as they are propoſed, do bring forth new knowledges: which thriddes they ſtill entermixe and weaue together, till they grow into a faire piece. And thus the ſciencies tehy ſo much labour for, and that haue ſo great an extent, do reſult out of few and ſimple notions in theire beginninges.

But before wee fall to mingling and comparing them together, I thinke it will not be amiſſe to ſett downe, and determine what kind of thinges wee meane by rare and what by denſe; to the end that when the names are agreed vpon, wee may ſlippe into no error by miſtaking them. So then, although there be ſeuerall conſiderations, in regard of which, rarity and denſity may be differently attributed to bodies: yet becauſe mans diſcerning them, to be able to diſcourſe accordingly of them, is the principall reſpect for which theire denominations are to be allotted them: wee may with reaſon call thoſe thinges denſe, wherein a man findeth a ſenſible difficulty to part them; and thoſe rare, where the reſiſtance is imperceptible.

And vnto theſe two notions of rarity and denſity, wee muſt allow a great latitude, farre from conſiſting in an indiuiſible ſtate; for ſeeing that rarefaction maketh a leſſer body equall to a bigger; and that all inequality betwixt two bodies, hath the conditions of a body; it followeth that the exceſſe of one body ouer an other, conſiſteth of infinite

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infinite partes into which it might be diuided: and consequently, that what is rarified, passeth as many degrees as the inequality or excesse hath partes. And the same law being in condensation, both dense and rare thinges must be acknowledged to be capable of infinite variety, and diuersity of states in regard of more and lesse in the same kind.

2. How moystnesse and drynesse are begotten in dense bodies.

These thinges being premised; and calling to mind that it is the nature of density to make the partes of a dense thing compact, and sticke together, and be hardly diuisible; and on the contrary side, that it is the nature of rarity, to diffuse and extend a rare thing, and to prepare and approach it to diuision, according to the proportion of the degree of rarity which it hath; and that weight doth abound where there is excesse of density, and is very litle or none in excesse of rarity: wee may now begin in our imagination to putt these qualities into the scales one against an other, to see what effects they produce in bodies. And first, lett vs weigh grauity against density or sticking together of partes: which sticking or compactednesse being naturall to density, requireth some excesse of grauity in proportion to the density, or some other outward violence, to breake it. If then in a dense body the grauity ouercome the density, and do make the partes of it breake a sunder, it will draw them downewardes towards the center that grauity tendeth vnto, and will neuer lett them rest till they come thither, vnlesse some impediment meete them by the way and stoppe theire iourney: so that such a body will, as neere as possibly it can, lye in a perfect sphericall figure in respect of the center; and the partes of it will be changed and altered, and thrust on any side that is the ready way thither; so that by the force of grauity working vpon it, it will runne as farre as it meeteth with nothing to hinder it from attaining this sphericall superficies. Wherefore such bodies, for the most part, haue noe settled outside of theire owne; but do receiue theire figure and limits from such letts as hinder them from attaining to that sphericalnesse they ayme att.

Now Aristotle (whose definitions, are in these matters generally receiued, as fully expressing the notions of mankind) telleth vs, and our owne experience confirmeth it, that wee vse to call those thinges *moist*, which runne in such sort as wee haue here sett downe; and that wee terme those thinges dry, which haue a consistence within themselues; and which to enioy a determinate figure, do not require the stoppe or hinderance of an other body to limit and circle them in: which will be the nature of those that haue a greater proportion of density in respect of theire grauity.

And thus, out of the comparison of density with weight, wee haue found two more qualities then wee yett had mett withall, namely wetteneſse and dryneſse. For although a body be dense, (which of its owne nature, singly considered, would preserue the continuity of its partes, as making the body hardly diuisible; whereby it would be

dry) yet if the grauity that worketh vpon it, be in proportion greater then the denſity; it will ſeuer the partes of it, and make them runne to the center, and ſo become fluide and moiſt: though not in the eminenteſt degree that may be of fluidity and moiſture; by reaſon that if the like ouerproportion of grauity happen in a rare body, it will there more powerfully worke its effect, then it can in a denſe body; becauſe a rare body will more eaſily obey, and yield to the grauity that maſtereth it, then a denſe one will; and conſequently, will be more fluide and moiſt then it.

3. How moyſtneſſe and dryneſſe are begotten in rare bodies.

Now on the other ſide, in weighing rarity againſt grauity; if it happen that the rarity ouercome the grauity, then the grauity will not change the figure of a body ſo proportioned, but what figure it hath from its proper naturall cauſes, the ſame will ſtill remaine with it: and conſequently, ſuch a body will haue termes of its owne and will not require an ambient body to limit, and circle it in: which nature, wee call dry.

But if the proportion of the grauity be the greater and do ouercome the rarity; then, by how much the rarity is greater, ſo much the more will the grauity force it, to apply it ſelfe equally and on all ſides to the center: and ſuch a body will the more eaſily receiue its figure from an other, and will be leſſe able to conſiſt of it ſelfe: which properties, wee attribute to wetteneſſe or moiſture. So that it appeareth, how the qualities of wett and dry, which firſt wee found in thinges that were denſe, are alſo common to that nature of bodies, which wee terme rare.

And thus, by our firſt inquiry after what kind of bodies do reſult out of the compounding of rarity and denſity with grauity, wee diſcouer foure different ſortes: ſome denſe ones that are dry, and others likewiſe denſe that are moiſt: then againe, ſome rare ones that are likewiſe moiſt, and other rare ones that are dry.

4. Heate is a property of rare bodies, and cold of denſe ones.

But wee muſt not reſt here: lett vs proceede a litle further, to ſearch what other properties theſe foure kindes of bodies will haue; which wee ſhall beſt diſcouer, if wee apply them ſeuerally to ſome other compounded body (of which nature, are all thoſe wee conuerſe with or ſee) and then conſider the effects which theſe do worke vpon it. To beginne with that, which wee ſaid, is ſo exceſſiuely rare that grauity hath no power ouer it. If wee looke vpon the multitude of litle partes it may be diuided into, whereof euery one will ſubſiſt by it ſelfe (for wee haue already prooued it dry) and then ſuppoſe them to be mooued with force and ſtrength againſt the body wee apply them to: it muſt neceſſarily follow, that they will forcibly gett into the porouſneſſe of it, and paſſe with violence betweene part and part, and of neceſſity ſeperate the partes of that thing one from an other; as a knife or wedge doth a ſolide ſubſtance, by hauing theire thinneſt partes preſſed into it: ſo that if in the compounded thing, ſome partes be more

be more weighty, others more light, (as of neceſſity there muſt be) the heavieſt will all fall loweſt, the lighteſt will fly vppermoſt, and thoſe which are of a meane nature betweene the two extremes, will remaine in the middle. In ſumme, by this action of an extreme rare body vpon a compounded one, all the partes of one kind that were in the compounded one, will be gathered into one place; and thoſe of diuers kindes into diuers places: which is the notion whereby Ariſtotle hath expreſſed the nature of heate; and is an effect, which dayly experience in burning and boyling, teacheth vs to proceede from heate. And therefore wee can not doubt, but that ſuch extreme rare bodies are as well hoat as dry.

On the other ſide, if a denſe thing be applyed to a compound, it will (becauſe it is weighty) preſſe it together: and if that application be continued on all ſides, ſo that noe part of the body that is preſſed be free from the ſiege of the denſe body that preſſeth it, it will forme it into a narrower roome, and keepe in the partes of it, not permitting any of them to ſlippe out. So that what thinges ſoeuer it findeth within its power to maſter, be they light or heauy, or of what contrary natures ſoeuer, it compreſſeth them as much as it can, and draweth them into a leſſe compaſſe, and holdeth them ſtrongly together, making them ſticke faſt to one an other. Which effect, Ariſtotle tooke for the proper notion of cold, and therefore gaue for definition of the nature of it, *that it gathereth thinges of diuers natures*: and experience sheweth vs in freeſing, and all great coolinges, that this effect proceedeth from cold.

5. Of the two denſe bodies, the leſſe denſe is more cold: but of the two rare ones the leſſe rare is leſſe hoat.

But if wee examine which of the two ſortes of denſe bodies (the fluide or the conſiſtent) is moſt efficacious in this operation; wee ſhall find that the leſſe denſe one is more capable of being applyed round about the body it ſhall beſiege; and therefore will ſtoppe cloſer euery litle hole of it, and will more eaſily ſend ſubtile partes into euery litle veine of it; and by conſequence, ſhrinke it vp together and coagulate, and conſtringe it more ſtrongly, then a body can that is extremely denſe; which by reaſon of its great denſity, and the ſtubborneſſe of its partes, can not ſo eaſily bend and plye them to worke this effect. And therefore, a body that is moderately denſe, is colder then an other that is ſo in exceſſe; ſeeing that cold is an actiue or working power, and that which is leſſe denſe doth excell in working.

On the contrary ſide, rare bodies being hoat, becauſe theire ſubtile partes enuironing a compounded body will ſinke into the pores of it, and to theire power ſeperate its partes; it followeth that thoſe wherein the grauity ouercometh the rarity, are leſſe hoat then ſuch others as are in the extremity, and higheſt exceſſe of rarity: both, becauſe the former are not able to pierce ſo litle partes of the reſiſting denſe body, as extreme rare ones are; and likewiſe, becauſe they

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more easily take plye by the obstacle of the solide ones they meete with, then these doe.

So that out of this discourse wee gather, that of such bodies that differ precisely by the proportion of Rarity and Density; those which are extremely rare, are in the excesse of heate, and are dry withall: that weighty rare bodies are extremely humide, and meanely hoat: that fluide dense bodies are moist, though not in such excesse as rare ones that are so; but are coldest of any: and lastly, that extreme dense bodies are lesse cold then fluide dense ones, and that they are dry.

6. The extreme dense body is more dry, then the extreme rare one.

But whether the extreme dense bodies, be more or lesse dry then such as are extremely rare, remaineth yet to be decided. Which wee shall easily doe, if wee but reflect that it is density which maketh a thing hard to be diuided, and that rarity maketh it easie: for, a facility to yield vnto diuision, is nothing else but a plyableness in the thing that is to be diuided, whereby it easily receiueth the figure, which the thing that diuideth it doth cast it into. Now this plyableness belongeth more to rare then to dense thinges: and accordingly, wee see fire bend more easily, by the concameration of an ouen, then a stone can be reduced into due figure by hewing. And therefore, since dryness is a quality that maketh those bodies wherein it raigneth, to conserue themselues in theire owne figure and limits, and to resist the receiuing of any from an other body; it is manifest that those are dryest, wherein these effects are most seene; which is, in dense bodies: and consequently, excesse of dryness must be allotted vnto them, to keepe company with theire moderate coldness.

7. There are but foure simple bodies: and these are rightly named Elements.

Thus wee see that the number of Elements assigned by Aristotle, is truly and exactly determined by him; and that there can be neither more nor lesse of them; and that theire qualities are rightly allotted to them: which to settle more firmely in our mindes, it will not be misse-spent time to summe vp in short, the effect of what wee haue hitherto said to bring vs vnto this conclusion. First, wee shewed that a body is made, and constituted a body by quantity. Next, that the first diuision of bodies is into rare and dense ones; as differing onely by hauing more and lesse quantity. And lastly, that the coniunction of grauity with these two, breedeth two other sortes of combinations: each of which is also twofold; the first sort, concerning rarity; out of which ariseth one extremely hoat and moderately dry, and an other extremely humide and moderately hoat: the second sort, concerning density; out of which, is produced one that is extremely cold and moderatly wett, and an other extremely dry and moderatly cold. And these are the combinations whereby are constituted, fire, ayre, water, and earth.

So that wee haue thus, the proper notions of the foure Elements; and haue both them and theire qualities driuen vp and resolued into theire most simple principles: which are, the notions of *Quantity*, and

and of the two moſt ſimple differences of quantatiue thinges, *Rarity and Denſity*. Beyond which, mans witt can not penetrate; nor can his wishes ayme att more in this particular: ſeeing he hath attained to the knowledge af what they are, and of what maketh them, be ſo, and that it is impoſſible they should be otherwiſe: and this, by the moſt ſimple and firſt principles, which enter into the compoſition of theire nature. Out of which it is euident, that theſe foure bodies are *Elements*: ſince they can not be reſolued into any others, by way of phyſicall compoſition; themſelues, being conſtituted by the moſt ſimple differences of a body. And againe, all other bodies whatſoeuer muſt of neceſſity, be reſolued into them, for the ſame reaſon; becauſe no bodies can be exempt from the firſt differencies of a body. Since then, wee meane by the name of an Element, *a body not compoſed of any former bodies, and of which all other bodies are compoſed*, wee may reſt ſatisfyed that theſe are rightly ſo named.

8. The Author doth nott determine whether euery element doth comprehend vnder its name one only loweſt ſpecies, or many: nor whether any of them be found pure.

But whether euery one of theſe foure elements, do comprehend vnder its name one onely loweſt ſpecies, or many (as, whether there be one onely ſpecies of fire, or ſeuerall; and the like of the reſt) wee intend not here to determine. Yet wee note, that there is a greate latitude in euery kind; ſeeing that, Rarity and Denſity (as wee haue ſaid before) are as diuiſible as quantity. Which latitudes, in the bodies wee conuerſe withall, are ſo limited that what maketh it ſelfe and other thinges be ſeene (as being accompanied by light) is called fire. What admitteth the illuminatiue action of fire, and is not ſeene, is called ayre. What admitteh the ſame action, and is ſeene (in the ranke of Elements) is called water. And what through the denſity of it admitteth not that action, but abſolutely reflecteth it, is called earth.

And out of all we ſaid of theſe foure Elements, it is manifeſt there can not be a fifth: as is to be ſeene att large in euery Ariſtotelian Philoſopher that writeth of this matter. I am not ignorant that there are ſundry obiections vſed to be made, both againſt theſe notions of the firſt qualities, and againſt this diuiſion of the Elements: but becauſe they, and theire ſolutions, are to be found in euery ordinary Philoſopher; and that they be not of any greate difficulty; and that the handling them, is too particular for the deſigne of this diſcourſe, and would make it too prolixe; I referre the Reader to ſeeke them for his ſatisfaction, it thoſe authors that treate phyſickes profeſſedly, and haue deliuered a compleate body of Philoſophy.

And I will end this Chapter with aduertiſing him (leaſt I should be misvnderſtood) that though my diſquiſition here hath pitched vpon the foure bodies of fire, ayre, water, and earth; yet it is not my intention to affirme, that thoſe which wee ordinarily call ſo, and do fall dayly within our vſe, are ſuch as I haue here expreſſed them: or that theſe Philoſophicall ones (which ariſe purely out of the combination of the firſt qualities) haue theire reſidence or conſiſtence in great

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bulkes, in any places of the world, be they neuer so remote: as, fire, in the hollow of the moones orbe; water, in the bottome of the sea; ayre, aboue the cloudes; and earth below the mines. But these notions are onely to serue for certaine Idæas of Elements; by which, the foure named bodies, and the compoundes of them, may be tryed and receiue their doome of more or lesse pure and approaching to the nature from whence they haue their denomination. And yet I will not deny, but that such perfect Elements may be found in some very litle quantities, in mixed bodies: and the greatest aboundance of them, in these foure knowne bodies that we call in ordinary practise, by the names of the pure ones: for they are least compounded, and approach most to the simplenesse of the Elements. But to determine absolutely their existence, or not existence, eyther in bulke or in litle partes; dependeth of the manner of action among bodies: which as yet we haue not meddled with.

THE FIFTH CHAPTER.

Of the Operations of the Elements in generall. And of their Actiuities compared with one another.

1. The first operation of the Elements is diuision, out of which resulteth locall motion.

HAVING by our former discourse, inquired out what degrees and proportions of rarity and density compounded with grauity, are necessary for the production of the Elements, and first qualities; whose combinations, frame the Elements: our next consideration, in that orderly progresse we haue proposed vnto our selues in this treatise (wherein our ayme is, to follow successiuely the steppes, which nature hath printed out vnto vs) will be to examine the operations of the Elements, by which they worke vpon one an other. To which end, lett vs propose to our selues: a rare and a dense body encountring one an other by the impulse of some exterior agent. In this case, it is euident, that since rarity implyeth a greater proportion of Qnantity, and quantity is nothing but diuisibility, rare bodies must needes be more diuisible then dense ones: and consequently, when two such bodies are pressed one against an other; the rare body not being able to resist diuision so strongly, as the dense one is; and being not permitted to retire backe, by reason of the externe violence impelling it against the dense body; it followeth, that the partes of the rare body must be seuered, to lett the dense one come betweene them: and so the rare body becometh diuided, and the dense body the diuider. And by this we see that the notions of diuider and diuisible, do immediately follow rare and dense bodies; and do so much the more properly agree vnto them, as they exceede in the qualities of Rarity and Density.

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Likewiſe, we are to obſerue in our caſe, that the denſe or diuiding body muſt neceſſarily cutt and enter further and further into the rare or diuided body; and ſo the ſides of it be ioyned ſucceſſiuely to new and new partes of the rare body that giueth way vnto it, and forſake others it parteth from. Now the rare body being in a determinate ſituation of the vniuerſe, (which we call *being in a place*, and is a neceſſary condition belonging to all particular bodies) and the denſe body coming to be within the rare body, whereas formerly it was not ſo: it followeth, that it looſeth the place it had, and gaineth an other. This effect, is that which we call locall motion.

2. What place is; both notionally, and really.

And thus we ſee, by explicating the manner of this action, that locall motion is nothing elſe, but the change of that reſpect or relation, which the body mooued hath to the reſt of the vniuerſe, following out of Diuiſion: and the name of locall motion, formally ſignifyeth onely the mutation of a reſpect to other extrinſecall bodies, ſubſequent to that diuiſion. And this is ſo euident and agreeable to the notions that all mankinde (who, as we haue ſaid, is iudge and maſter of language) naturally frameth of place; as I wonder much why any will labour to giue other artificiall and intricate doctrine of this that in it ſelfe is ſo plaine and cleare. What neede is there to introduce an imaginary ſpace (or with Ioannes Grammaticus, a ſubſiſtent quantity) that muſt runne through all the world; and then entayle to euery body an ayery entity, an vnconceiuable moode, an vnintelligible Vbi, that by an intrinſecall relation to ſuch a part of the imaginary ſpace, muſt thereunto pinne and faſten the body it is in? It muſt needes be a ruinous Philoſophy that is grounded vpon ſuch a contradiction, as is the allotting of partes vnto that, which the authors themſelues (vpon the matter) acknowledge to be meerely nothing; and vpon ſo weake a ſhift, (to deliuer them from the inconueniencies that in theire courſe of doctrine other circumſtances bring them vnto) as is the voluntary creating of new imaginary Entities in thinges, without any ground in nature for them. Learned men should expreſſe the aduantage and ſubtility of theire wittes, by penetrating further into nature, then the vulgar; not, by vexing and wreſting it from its owne courſe. They should refine, and carry higher; not contradict and deſtroy the notions of mankind, in thoſe thinges that it is the competent Iudge of: as it vndoubtedly is, of thoſe primary notions which Ariſtotle hath ranked vnder ten heades: which (as we haue touched before) euery body can conceiue in groſſe: and the worke of ſchollers, is to explicate them in particular; and not to make the vulgar beleeue they are miſtaken, in framing thoſe apprehenſions that nature taught them.

Out of that which hath been hitherto reſolued it is manifeſt, that place really and abſtracting from the operation of the vnderſtanding, is nothing elſe but the inward ſuperficies of a body that compaſſeth

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and immediately containeth an other. Which ordinarily, being of a rare body that doth not shew it selfe vnto vs (namely, the ayre) is for the most part vnknowne by vs. But because nothing can make impression vpon our mind, and cause vs to giue it a name; otherwise then by being knowne: therefore our vnderstanding to make a compleate notion, must adde something else to this fleeting and vnremarkable superficies that may bring it vnto our acquaintance. And for this end we may consider further, that as this superficies hath in it selfe, so the body enclosed in it gaineth, a certaine determinate respect unto the stable and immoouable bodies that enuiron it. As for example, we vnderstand such a tree to be in such a place, by hauing such and such respects to such a hill neere it, or to such a house that standeth by it, or to such a riuer that runneth vnder it, or to such an immoouable point of the heauen that from the sunnes rising in the æquinox is called east, and such like. To which purpose, it importeth not whether these, that we call immoouable bodies and pointes, be truly so, or do but seeme so to mankinde. For man talking of thinges according to the notions he frameth of them in his minde, (speech, being nothing else but an expression to an other man, of the images he hath within himselfe) and his notions being made according to the seeming of the thinges; he must needes make the same notions, whether the thinges be truly so in themselues, or but seeme to be so, when that seeming or appearance is alwayes constantly the same.

3. Locall motion is that diuision, whereby a body changeth its place.

Now then, when one body diuiding an other, getteth a new immediate cloathing; and consequently, new respects to the stable and immoouable bodies (or seeming such) that enuiron it; we do vary in our selues the notion we first had of that thing; conceiuing it now accompanied with other circumstances and other respects then formerly it had. Which notion we expresse by saying, it hath changed its place; and is now no longer where it was att the first. And this change of place, we call *Locall motion:* to witt, the departing of a body from that hollow superficies which inclosed it; and its changing vnto an other; whereby it gaineth new respects to those partes of the world that haue, or in some sort may seeme to haue, immobility and fixed stableness. So as hence it is euident that the substance of locall motion consisteth in diuision; and that the alteration of Locality followeth diuision; in such sort as becoming like or vnlike of one wall to an other, followeth the action whereby one of them becometh white.

4. The nature of quantity of it selfe is sufficient to vnite a body to its place.

And therefore in nature we are not to seeke for any entity or speciall cause of applying the mooued body to a place as place, (which is but a respect consequent to the effect of diuision) but onely to consider what reall and physicall action vniteth it to that other body, which is called its place, and truly serueth for that effect. And consequently, they who thinke they haue discouered a notable subtility by bringing in an Entity to vnite a body to its place, haue strained beyond

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beyond theire ſtrength, and haue graſped but a shadow. Which will appeare yet more euident, if they but marke well how nothing is diuiſible, but what of it ſelfe (abſtracting from diuiſion) is one. For the nature of diuiſion, is *the making of many*; which implyeth, that what is to be diuided, muſt of neceſſity be not *many* before it be diuided. Now quantity being the ſubiect of diuiſion, it is euident that purely of it ſelfe, and without any force or adioyned helpes, it muſt needes be one, whereſoeuer ſome outward agent doth not introduce multiplicity vpon it. And whenſoeuer other thinges worke vpon quantity as quantity, it is not the nature and power of theire operation, to produce vnity in it and make it one; for it is already one: but contrariwiſe, the immediate neceſſary effect that floweth from them in this caſe, is to make one quantity many, according to the circumſtances that accompany the diuider, and that which is to be diuided. And therefore, although wee may ſeeke cauſes why ſome one thing ſticketh faſter together then ſome other, yet to aske abſolutely why a body ſticketh together, were preiudiciall to the nature of quantity; whoſe eſſence is, to haue partes ſticking together, or rather, to haue ſuch vnity, as without it, all diuiſibility muſt be excluded.

Out of which diſcourſe it followeth, that in locall motion we are to looke only for a cauſe or power to diuide, but not for any to vnite. For the very nature of quantity vniteth any two partes that are indiſtant from one an other, without needing any other cement to glew them together: as we ſee the partes of water and all liquide ſubſtances, do preſently vnite themſelues to other partes of like bodies, when they meete with them, and to ſolide bodies if they chance to be next vnto them. And therefore it is vaine to trouble our heades with Vnions and imaginary Moodes to vnite a body to the place it is in, when theire owne nature maketh them one as ſoone as they are immediate to each other. And accordingly, if when we ſee a boule mooue, we would examine the cauſes of that motion, we muſt conſider the quantity of ayre or water it maketh to breake from the partes next vnto it, to giue place vnto it ſelfe: and not ſpeculate vpon an intrinſecall relation from the body to a certaine part of the imaginary ſpace they will haue to runne through all thinges. And by ballancing that quantity of ayre or water which it diuideth, we may arriue to make an eſtimate of what force the boule needeth to haue for its motion.

5. All operations amongſt bodies, are eyther locall motion, or ſuch as follow out of locall motion.

Thus hauing declared that the locality of motion, is but an extrinſecall denomination, and no reality in the thing mooued; wee may now caſt an eye vpon a vaſt conſequence that may be deduced out of what wee haue hitherto ſaid. For if we conſider the nature of a body, that is, that a body is a body by quantity; and that the formall notion of quantity is nothing elſe but diuiſibility; and that the adæquate act of diuiſibility, is diuiſion: it is euident, there can be no

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other operation vpon quantity, nor (by conſequence) among bodies, but muſt eyther be ſuch diuiſion, as we haue here explicated, or what muſt neceſſarily follow out of ſuch diuiſion. And diuiſion, (as we haue euen now explicated) being locall motion; it is euident, that all operations among bodies, are either locall motion, or ſuch as follow out of locall motion. Which concluſion, howſoeuer vnexpected, and may att the firſt hearing appeare a Paradoxe; will neuertheleſſe by the enſuing worke receiue ſuch euidence, as it can not be doubted of; and that, not onely by force of argumentation and by neceſſity of notions (as is already deduced) but alſo by experience, and by declaration of particulars as they shall occurre.

6. Earth compared to water in actiuity.

But now to apply what we haue ſaid, to our propoſed ſubiect: it is obuious to euery man, that ſeeing the diuider is the agent in diuiſion and in locall motion; and that denſe bodies, are by theire nature diuiders; the earth, muſt in that regard be the moſt actiue among the Elements, ſince it is the moſt denſe of them all. But this ſeemeth to be againſt the common iudgement of all the ſearchers of nature; who vnanimouſly agree that fire is the moſt actiue Element. As alſo, it ſeemeth to impugne what we our ſelues haue determined, when we ſaid, there were two actiue qualities, heate and cold, whereof the firſt was in its greateſt exceſſe in fire, and the latter in water.

To reconcile theſe, we are to conſider that the action of cold in its greateſt height, is compoſed of two partes; the one is a kind of preſſing; and the other, is penetration which requireth applicability. Of which two, the former ariſeth out of denſity, but the latter, out of moderation of denſity, as I haue declared in the precedent Chapter.

§. 6. Wherefore the former will exceede more in earth; though the whole be more eminent in water. For though conſidering onely the force of moouing (which is a more ſimple and abſtracted notion, then the determination and particulariſation of the Elements, and is precedent to it) therein earth hath a precedency ouer water: yet taking the action as it is determined to be the action of a particular Element, and as it concurreth to the compoſition or diſſolution of mixed bodies; in that conſideration (which is the chiefe worke of Elements, and requireth an intime application of the Agents) water hath the principality and exceſſe ouer earth.

7. The manner whereby fire getteth into fewel: prooueth that it exceedeth earth in actiuity.

As for fire it is more actiue then eyther of them; as it will appeare clearely if we conſider, how when fire is applyed to fewell, and the violence of blowing is added to its owne motion; it incorporateth it ſelfe with the fewell, and in a ſmall time conuerteth a great part of it into its owne nature, and shattereth the reſt into ſmoake and ashes. All which proceedeth from the exceeding ſmallneſſe and dryneſſe of the partes of fire; which being mooued with violence againſt the fewell, and thronging in multitudes vpon it; they eaſily pierce the porous ſubſtance of it, like ſo many extreme sharpe needles.

And

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And that the force of fire is as greate and greater, then of earth, we may gather out of our former diſcourſe; where hauing reſolued, that denſity is the vertue by which a body is moued and doth cutt the medium; and againe conſidering that celerity of motion, is a kind of denſity, (as we shall by and by declare) it is euident, that ſince blowing muſt of neceſſity preſſe violently and with a rapide motion, the partes of fire againſt the fewell, and ſo condenſe them exceedingly there, (both by theire celerity, and by bringing very many partes together there;) it muſt needes alſo giue them actiuity and vertue to pierce the body they are beaten againſt.

Now, that celerity is akind of denſity, will appeare by comparing theire natures. For if we conſider that a denſe body may be dilated ſo as to poſſeſſe and fill the place of a rare body that exceeded it in bigneſſe; and by that dilatation, may be diuided into as many and as greate partes as the rare body was diuiſible into; wee may conceiue that the ſubſtance of thoſe partes, was by a ſecret power of nature foulded vp in that litle extenſion in which it was before. And euen ſo, if we reflect vpon two riuers of equall channels and depths, whereof the one goeth ſwifter then the other; and determine a certaine length of each channell, and a common meaſure of time: wee shall ſee that in the ſame meaſure of time, there paſſeth a greater bulke of water in the deſigned part of the channell of the ſwifter ſtreame, then in the deſigned part of the ſlower, though thoſe partes be equall.

Neither doth it import, that in velocity we take a part of time, whereas in denſity it ſeemeth that an inſtant is ſufficient; and conſequently, there would be no proportion betweene them. For knowing Philoſophers do all agree that there are no inſtants in time, and that the apprehenſion of them proceedeth meerely from the manner of our vnderſtanding. And as for partes in time, there can not be aſſumed any ſo litle, in which the compariſon is not true: and ſo in this regard, it is abſolutely good.

And if the Reader haue difficulty att the diſparity of the thinges which are preſſed together in denſity and in celerity; for that in denſity there is onely ſubſtance, and in celerity there is alſo quantity, crowded vp with the ſubſtance; he will ſoone receiue ſatisfaction, when he shall conſider that this diſparity is to the aduantage of what we ſay, and maketh the nature of denſity more perfect in celerity, and conſequently more powerfull in fire then in earth. Beſides, if there were no diſparity, it would not be a diſtinct ſpecies of denſity, but the very ſame.

8. The ſame is prooued by the manner, whereby fire cometh out of fewell and worketh vpon other bodies.

By what we haue ſpoken aboue, it appeareth how fire getteth into fewell; now lett vs conſider how it cometh out: for the actiuity of that fierce body, will not lett it lye ſtill and reſt, as long as it hath ſo many enemies round about it to rouſe it vp. Wee ſee then that as ſoone as it hath incorporated it ſelfe with the fewell, and is growne

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maſter of it by introducing into it ſo many of its owne partes, (like ſo many ſoldiers, into an enemies towne) they breake out againe on euery ſide with as much violence as they came in. For by reaſon of the former reſiſtance of the fewell; theire continuall ſtreaming of new partes vpon it, and one ouertaking an other there where theire iourney was ſtopped, (all which is encreaſed by the blowing,) doth ſo exceedingly condenſe them into a narrower roome then theire nature affecteth, that as ſoone as they gett liberty, and grow maſters of the fewel, (which att the firſt was theire priſon) they enlarge theire place, and conſequently come out and flye abroad; euer ayming right forwardes from the point where they begin theire iourney: for the violence wherewith they ſeeke to extend themſelues into a larger roome, when they haue liberty to do ſo; will admitt no motion but the ſhorteſt, which is, by a ſtraight line.

So that if in our fantaſie, we frame an image of a round body all of fire; wee muſt withall preſently conceiue, that the flame proceeding from it, would diffuſe it ſelfe euery way indifferently in ſtraight lines; in ſuch ſort, that the ſource ſeruing for the center, there would be round about it an huge ſphere of fire and of light; vnleſſe ſome accidentall and externe cauſe, should determine its motion more to one part then to an other. Which compaſſe, becauſe it is round, and hath the figure of a ſphere, is by Philoſophers termed the ſphere of its actiuity.

So that it is euident, that the moſt ſimple and primary motion of fire, is a fluxe in a direct line from the center of it, to its circumference, taking the fewell for its center: as alſo, that when, it is beaten againſt a harder body, it may be able to deſtroy it, although that body be in its owne nature, more denſe then fire. For the body againſt which it preſſeth; eyther hath pores, or hath none, (as, the Elements haue none:) if it hath pores; then the fire, by reaſon of the violent motion of the impellent, driueth out the litle bodies which fill vp thoſe pores, and ſucceeding in theire roome, and being multiplyed there, cauſeth thoſe effects which in our diſcourſe of the Elemenrs we aſſigned to heat. But if it haue no pores; it will be eyther rare, or denſe: if it be rare; then, in caſe that the force of the impellent be greater then the reſiſtance of the rare body, it will force the fire to diuide the rare body. But if it be denſe; as, ſome atome of earth; then, though att the firſt it can not diuide it; yet by length of time and by continuall beating vpon it, it may come to weare off ſome part of it, the force of the impellent, by litle and litle bending the atome of the earth, by driuing a continuall ſtreame of a leſſer part of fire, againſt ſome determinate part of the atome. By which word *Atome*; no body will imagine we intend to expreſſe a perfect indiuiſible, but onely, the leaſt ſort of naturall bodies.

THE

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THE SIXT CHAPTER.

Of Light: what it is.

HAVING ſaid thus much of fire; the neere relation that is betweene it and light, inuiteth vs in the next place to bend our eyes to that which vſeth to dazell theires who looke vnwarily vpon it. Certainely, as among all the ſenſible qualities, it is the principall; ſo among all corporeall thinges, it ſeemeth to ayme righteſt att a ſpirituall nature, and to come neereſt vnto it. And by ſome hath beene iudged to be ſpirituall; if our eyes be capable to ſee ſpirits. No meaner man then Ariſtotle, leadeth the dance to hold light a quality, and mainely to deny it any bodily ſubſiſtence. And there hath followed him no fewer, then almoſt all the world euer ſince. And the queſtion importeth no leſſe, then the whole doctrine of qualities; for admitt light to be a body, and hardly any man will hold vp his hand in defence of any other quality: but if it be a quality; then all others come in by parity and for company. 1. In what ſenſe the Author reiecteth qualities.

But before we goe any further, it will not be amiſſe to expreſſe what we meane when we reiect qualities; and how, in ſome ſenſe, we are content to admitt them. According to that deſcription that Philoſophers ordinarily do make of them, (and eſpecially the moderne) we can by no meanes giue way vnto them. I confeſſe ingenuouſly, I vnderſtand not what they meane by them; and I am confident, that neither do they. For the very notion, that theire firſt wordes ſeeme to expreſſe of them, they contradict againe, before they make an end of deſcribing what they are. They will haue them to be reall *Entities* or *Thinges*, diſtinct from the bodies they accompany: and yet, they deny them a ſubſiſtence or ſelf being; ſaying they do but inhere in theire ſubiect, which ſupporteth them; or which is all one, that their being is a dependence of a ſubiect.

If they will reflect vpon what they ſay, and make theire thoughts and theire wordes agree; they will find, that the firſt part of theire deſcription, maketh them complete ſubſtances; which afterwardes, in wordes they flattely deny: and it is impoſſible to reconcile theſe two meaninges. A reall Entity or thing, muſt neceſſarily haue an *Exiſtence* or *Being* of its owne: which they allow them. And whatſoeuer hath ſo; becometh a ſubſtance: for it ſubſiſteth by its owne Exiſtence; or, (to ſay plainer) is what it is by its owne Being; and needeth not the exiſtence of an other thing to giue it a *Being*. And then preſently to ſay that it doth not ſubſiſt of it ſelfe; or that it requireth the ſubſiſtence of a ſubſtance, to make it *Bee*; is a pure contradiction to the former.

This ariſeth from a wrong notion they make to themſelues of

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ſubſtance, exiſtence and ſubſiſtence: and from theire not conſulting ſufficiently with theire owne thoughts, as well as ſtudying in bookes. They meete there with different termes; by helpe of which, they keepe themſelues from contradiction in wordes, but not in effect. If the termes were rightly conceiued, and notions duely fitted to them, (which requireth deepe meditation vpon the thinges themſelues, and a braine free from all inclination to ſiding, or affection to opinions for the authors ſakes, before they be well vnderſtood and examined) many of thoſe diſputes would fall to the ground, in which oftentimes both ſides looſe themſelues, and the queſtion, before they come to an end. They are in the darke before they are aware: and then, they make a noiſe, onely with termes; which like too heauy weapons that they can not weild, do carry theire ſtroakes beyond theire ayme. Of ſuch nature, are the qualities and moodes, that ſome moderne Philoſophers haue ſo ſubtiliſed vpon. And in that ſenſe, we vtterly deny them: which being a queſtion appertaining to Metaphyſickes, it belongeth not to our preſent purpoſe to ingage our ſelues further in it.

2. In what ſenſe the Author doth admitt of qualities.

But, as they are ordinarily vnderſtood in common conuerſation, we allow them. And our worke is but to explicate and shew the particulars in retaile, of what men naturally ſpeake in groſſe. For that, ſerueth theire turne to know what one an other meaneth: whereas, it belongeth onely vnto a Philoſopher, to examine the cauſes of thinges. Others, are content with the effects: and they ſpeake truly and properly when they deſigne them. As for example: when they ſay that fire burneth by a quality of heate that it hath, or that a deye is ſquare by the quality of a cubicall figure that is in it; they ſpeake as they should do. But if others will take occaſion vpon this, to lett theire vnderſtanding giue a *Being* vnto theſe qualities, diſtinct from the ſubſtances in which they conceiue them; there they miſſe. If we conſider the ſame man hungry, or thirſty, or weary, or ſleepy, or ſtanding, or ſitting; the vnderſtanding preſently maketh within it ſelfe, reall thinges of ſleepe, hunger, thirſt, wearineſſe, ſtanding, and ſitting. Whereas indeed, they are but different affections or ſituations of the ſame body. And therefore we muſt beware of applying theſe notions of our mind, to the thinges as they are in themſelues: as much as we muſt, of conceiuing thoſe partes to be actually in a continued quantity, whereof we can frame actually diſtinct notions in our vnderſtanding. But as, when ordinary men ſay, that a yard containeth three feete; it is true in this ſenſe, that three feete may be made of it; but that whiles it is a yard, it is but one quantity or thing, and not three thinges: ſo, they who make profeſſion to examine rigorouſly the meaning of wordes, muſt explicate in what ſenſe it is true that heate and figure (our former examples) are qualities: for ſuch we grant them to be; and in no wiſe do contradict the common

common manner of ſpeech; which entereth not into the Philoſophicall nature of them.

Wee ſay then, that qualities are nothing elſe but the proprieties, or particularities wherein one thing differeth from an other. And therefore Logicians, call ſubſtantiall differencies, ſubſtantiall qualities: and ſay, they are prædicated in *Quale quid*. But the Prædicament of *Quality*, is ordered by Ariſtotle to conclude in it thoſe differences of thinges, which are neither ſubſtantiall nor quantitatiue, and yet are intrinſecall and abſolute. And ſo, that which the vnderſtanding calleth heate, and maketh a notion of, diſtinct from the notion of the fire from whence it iſſueth to burne the wood that is neere it; is nothing elſe, in the fire, but the very ſubſtance of it in ſuch a degree of rarity; or a continuall ſtreame of partes iſſuing out of the maine ſtocke of the ſame fire, that entereth into the wood, and by the rarity of it maketh its way through euery litle part, and diuideth them. All which actions, are compriſed by the vnderſtanding, vnder one notion of burning: and the power, (which is fire it ſelf) to doe theſe actions, vnder one notion of the quality of heate: though burning in effect, and explicated Philoſophically, be nothing elſe but the continuance of thoſe materiall motions we haue euen now deſcribed. In like manner, the cubicall figure of a deye, is nothing elſe but the very body of the deye it ſelfe, limited by other bodies from being extended beyond thoſe dimenſiós it hath: and ſo the quality of figure or ſquareneſſe, which in common ſpeech is ſaid to be in it; is truly, the ſubſtance it ſelfe, vnder ſuch a conſideration as is expreſſed by that word.

3. Fiue arguments propoſed to proue that light is not a body.

But to come to our queſtion, vpon the deciſion of which dependeth the fate of all the fictitious Entities, which in the ſchooles are termed qualities. The cheife motiues that perſuade light to be one of thoſe; may, to my beſt remembrance, be reduced to fiue ſeuerall heades. The firſt is, that it illuminateth the ayre in an inſtant, and therefore, can not be a body: for a body requirreth ſucceſſion of time to mooue in: whereas, this ſeemeth to ſpread it ſelfe, ouer the whole hemiſphere in an inſtant; for as farre as the ſunne is diſtant from vs, he no ſooner raiſeth his head aboue our horizon, but his dartes are in our face: and generally, no imagination can be framed, of any motion it hath in its dilatation.

The next is; that whereas no body can admitt an other into its place, without being remooued away it ſelfe, to leaue that roome vnto the aduenient one; neuertheleſſe, plaine experience sheweth vs dayly, that two lights may be in the ſame place; and the firſt is ſo farre from going away att the coming of the ſecond, that the bringing in of a ſecond candle, and ſetting it neere the firſt, encreaſeth the light in the roome; which diminisheth againe when the ſecond is remooued away. And by the ſame reaſon; if light were a body, it ſhould driue away the ayre (which is likewiſe a body) where-

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ſoeuer it is admitted: for within the whole ſphere of the irradiation of it, there is no point wherein one may ſett their eye, but light is found. And therefore; if it were a body, there would be no roome for ayre in that place which light taketh vp. And likewiſe, we ſee that it penetrateth all ſolide bodies, (and particularly glaſſe,) as experience sheweth, in wood, ſtone, mettals, and any other body whatſoeuer, if it be made thinne enough.

The third argument, why light can not be a body, is, that if it were ſo, it can be none other but fire, which is the ſubtileſt, and moſt rarifyed of all bodies whatſoeuer. But if it be fire, then it can not be without heate: and cõſequently, a man could not feele cold in a ſunne-shining day. The contrary of which is apparent all winter long; whoſe brigheſt dayes oftentimes proue the coldeſt. And Galilæus with diuers others ſince, did vſe from the ſunne to gather light in a kind of ſtone that is found in Italy (which is therefore by them called, *la calamita della luce*) and yet no heate appeared in it. A glow worme will giue light to read by, but not to warme you any whitt att all. And it is ſaid, that diamonds and carbuncles will shine like fire in the greateſt darkes; yet no man euer complained of being ſerued by them, as the foolish Satyre was by kiſſing of a burning coale. On the contrary ſide; if one conſider how great heates may be made without any light att all, how can one be perſwaded that light and heate shoud be the ſame thing, or indeed any whitt of kinne?

The fourth motiue to induce vs to beleeue that light can not be a body; is the ſuddaine extinction of it, when any ſolide body cometh betweene the fountaine of it, and the place where he ſendeth his beames. What becometh of that great expanſion of light that shined all about, when a cloud interpoſeth it ſelfe betweene the body of the ſunne and the ſtreames that come from it? Or when it leaueth our horizon to light the other world? His head is no ſooner out of our ſight; but att the inſtant all his beames are vanished. If that which filleth ſo vaſt a roome were a body, ſome thing would become of it: it would att leaſt be changed to ſome other ſubſtance; and ſome relikes would be left of it; as when ashes remaine of burned bodies: for nature admitteth not the annihilation of any thing.

And in the laſt place; we may conceiue that if light were a body, it would be shaken by the windes, and by the motion of the ayre; and wee should ſee it quauer in all bluſtering weather. Therefore, ſumming vp all we haue ſaid; it ſeemeth moſt improbable, and indeed wholy impoſſible, that light should be a body; and conſequently, muſt haue his place among qualities.

4. The two firſt reasõs to proue light to be a body are, the

But on the other ſide; before we apply ourſelues to anſwere theſe obiections, lett vs take a short ſuruay of thoſe inducements, that preuayle with vs to beleeue light a body, notwithſtanding ſo forcible oppoſitions. I admitt ſo farre of the thitd argument, as to allow light to be

to be fire: for indeed it can not be imagined to be any thing elſe; all properties agreeing ſo fully betweene them. But withall I muſt adde; that it is not fire in euery forme, or fire ioyned with euery ſubſtance, that expreſſeth it ſelfe by light; but it is fire extremely dilated, and without mixture of any other groſſe body. Lett mee hold a piece of linnen or paper, cloſe by the flame of a candle, and by litle, and litle remooue it further and further of; and me thinkes my very eyes tell me, that there is vpon the paper ſome part of that which I ſee in the candle; and that it groweth ſtill leſſe and leſſe like as I remooue the paper further from it: ſo that, if I would beleeue my ſenſe; I should beleeue it as very a body vpon the paper, as in the candle; though enfeebled, by the laxity of the channell in which it floweth.

reſemblance it hath with fire; and becauſe if it were a quality, it would alwayes produce an equall to it ſelfe.

And this ſeemeth to be ſtrengthened, by the conſideration of the aduerſaries poſition: for if it were a quality; then, ſeeing it hath no contrary to deſtroy or ſtoppe it, it should ſtill produce an equall to it ſelfe, without end or growing feeble, whenſoeuer it meeteth with a ſubiect capable to entertayne it, as ayre is.

5. The third reaſon; becauſe if we imagine to our ſelues the ſubſtance of fire to be rarifyed, it will haue the ſame appearances which light hath.

The better to apprehend how much this faint reſemblance of flame vpon the paper, maketh for our purpoſe; lett vs turne the leafe, and imagine in our owne thoughts, after what faſhion that fire which is in the flame of a litle candle, would appeare vnto vs, if it were dilated and ſtretched out to the vtmoſt extent, that exceſſe of rarity can bring it vnto. Suppoſe that ſo much flame, as would fill a cone of two inches height and halfe an inch diameter should ſuffer ſo great an expanſion as to replenish with his light body a large chamber: and then, what can we imagine it would ſeeme to be? How would the continuall driuing it into a thinner ſubſtance, as it ſtreameth in a perpetuall flood from the flame, ſeeme to play vpon the paper? And then iudge whether it be likely to be a body or no, when our diſcourſe ſuggeſteth vnto vs, that if it be a body, thoſe very appearances muſt follow, which our eyes giue vs euidence are ſo in effect. If gold beaten into ſo ayery a thinneneſſe as we ſee guilders vſe, doth remaine ſtill gold notwithſtanding the wonderfull expanſion of it: why shall we not allow, that fire dilated to his vtmoſt periode, shall ſtill remaine fire; though extremely rarifyed beyond what is was?

6. The fourth reaſon, from the manner of the generation and corruption of light, which agreeth with fire.

We know that fire is the rareſt and the ſubtileſt ſubſtance that nature hath made among bodies; and we know likewiſe, that it is engendered by the deſtroying and feeding vpon ſome other more groſſe body: lett vs then calculate, when the oyle, or tallow, or waxe of a candle, or the bulke of a fagott or billet, is dilated and rarifyed to the degree of fire; how vaſt a place muſt it take vp?

To this lett vs adde what Ariſtotle teacheth vs; that fire is not like a ſtanding poole, which continueth full with the ſame water; and as it hath no waſt, ſo hath it no ſupply: but it is a fluent and brookelike current. Which alſo we may learne, out of the perpetuall nutriment

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it requireth: for a new part of fewell, being conuerted into a new part of fire (as we may obſerue, in the litle atomes of oyle, or melted waxe, that continually aſcend apace vp the weeke of a burning candle or lampe) of neceſſity the former muſt be gone to make roome for the latter; and ſo, a new part of the riuer is continually flowing.

Now then, this perpetuall fluxe of fire, being made of a groſſe body that ſo rarifyed will take vp ſuch a vaſt roome; if it dye not att the inſtant of its birth, but haue ſome time to ſubſiſt (be it neuer ſo short,) it muſt needes runne ſome diſtance from the fountaine whence it ſpringeth. Which if it do; you neede not wonder, that there should be ſo great an extent of fire as is requiſite to fill all that ſpace which light replenisheth; nor, that it should be ſtill ſupplyed with new, as faſt as the cold of the ayre killeth it: for conſidering that flame is a much groſſer ſubſtance then pure fire, (by reaſon of the mixture with it, of that viſcous oyly matter, which being drawne out of the wood and candle, ſerueth for fewell to the fire, and is by litle and litle conuerted into it;) and with all reflecting vpon the nature and motion of fire, (which is, to dilate it ſelfe extremely, and to fly all about from the center to the circumference;) you can not chooſe but conceiue, that the pure fire ſtruggling to breake away from the oyly fewell (which is ſtill turning into new fire) doth att length free his winges from that birdlime, and then flyeth abroad with extreme ſwiftneſſe, and ſwelleth and dilateth it ſelfe to a huge bulke, now that it hath gotten liberty; and ſo filleth a vaſt roome; but remaineth ſtill fire till it dye: which it no ſooner doth, but it is ſtill ſupplyed with new ſtreames of it, that are continually ſtrained, and as it were ſqueeſed, out of the thicke flame, which did impriſon it, and kept it within it; till growing fuller of fire then it could containe (by reaſon of the continuall attenuating the oyly partes of it, and conuerting them into fire) it giueth liberty vnto thoſe partes of fire, that are next the ſuperficies, to fly whither theire nature will carry them.

And thus, diſcourſe would informe a blind man (after he hath well reflected on the nature of fire) how it muſt needes fill a mighty extent of place; though it haue but a narrow begining att the ſpring-head of it: and that there, by reaſon of the condenſation of it, and mixture with a groſſer body, it muſt needes burne other bodies: but that when it is freed from ſuch mixture, and ſuffereth an extreme expanſion, it can not haue force to burne, but may haue meanes to expreſſe it ſelfe to be there preſent by ſome operation of it vpon ſome body that is refined and ſubtiliſed enough to perceiue it. And this operation, a ſeeing man, will tell you is done vpon his eyes, (whoſe fitteneſſe to receiue impreſſion from ſo ſubtile an Agent, Anatomiſtes will teach you.) And I remember, how a blind ſchoolemaſter that I kept in my houſe to teach my children, (who had extreme ſubtile

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ſpirits, and a great tenderneſſe through his whole body; and mett with few diſtractions, to hinder him from obſeruing any impreſſion, neuer ſo nicely made vpon him) vſed often to tell me, that he felt it very perceptibly in ſeuerall partes of his body; but eſpecially in his braine.

But to ſettle vs more firmely in the perſuaſion of light his being a body (and conſequently fire;) lett vs conſider that the properties of a body, are perpetually incident to light; looke what rules a ball will keepe in its reboundes; the ſame, doth light in its reflexions: and the ſame demonſtration, doth alike conuince the one and the other. Beſides, light is broken like a body; as when it is ſnapped in pieces by a tougher body. It is gathered together into a litle roome, by looking or burning glaſſes; as water is, by ordering the gutters of a houſe ſo as to bring into one ciſterne, all that raineth diſperſedly vpon the whole roofe. It is ſeuered and diſperſed by other glaſſes; and is to be wrought vpon, and caſt hither and thither, att pleaſure; all, by the rule of other bodies. And what is done in light, the ſame will likewiſe be done in heate, in cold, in wind, and in ſound. And the very ſame inſtruments, that are made for light; will worke their effects in all theſe others, if they be duly managed. 7. The fifth reaſon; becauſe ſuch properties belong to light as agree only vnto bodies.

So that certainely, were it not for the authority of Ariſtotle and of his learned followers, that preſſeth vs on the one ſide; and for the ſeemingneſſe of thoſe reaſons we haue already mentioned, which perſuadeth vs on the other ſide; our very eyes would carry vs by ſtreame into this conſent, that light is no other thing but the nature and ſubſtance of fire, ſpred farre and wide, and freed from the mixture of all other groſſe bodies. Which will appeare yet more euident in the ſolutions of the oppoſitions we haue brought againſt our owne opinion: for in them there will occurre other arguments of no leſſe importance to prooue this verity, then theſe we haue already propoſed.

THE SEVENTH CHAPTER.

Two obiections anſwered againſt light being fire; with a more ample proofe of its being ſuch.

HAVING then ſaid thus much to perſuade vs of the corporeity of this ſubtile thing, that ſo queintly playeth with our eyes: wee will in the next place examine thoſe obiections that at the beginning we did ſett downe againſt its being a body: and if after a through diſcuſſion of them, we find they do in truth conclude nothing of what att the firſt ſight they beare ſo great a shew of; but that we shall be able, perfectly to ſolue and enerue 1. That all light is hoat and apt to heate.

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their force; no body will thinke it rashneſſe in vs to craue leaue of Ariſtotle that we may diſſent from him in a matter that he hath not looked to the bottome of; and whoſe opinion therein, can not be defended from plaine contradictions and impoſſibilities. It is true, neuer any one man looked ſo farre as he into the bowels of nature; he may rightly be termed the Gemus ofit; and whoſoeuer followeth his principles in the maine, can not be led into error: but we muſt not beleeue, that he, or any man elſe that relyeth vpon the ſtrength and negotiation of his owne reaſon, euer had a priuiledge of infallibility entayled to all he ſaid. Lett vs then admire him for what he hath deliuered vs: and where he falleth short, or is weary in his ſearch, and ſuffereth himſelfe to be borne downe by popular opinions againſt his owne principles (which happeneth very ſeldome to him) lett vs ſeeke to ſupply and relieue him.

But to purſue our intent: wee will begin with anſwering the third obiection; which is, that if light were fire, it muſt heat as well as enlighten where it shineth. There is no doubt but it doth ſo: as is euident by the weather glaſſes, and other artificiall muſicall inſtruments (as organs and virginals that played by themſelues) which Cornelius Drebbel (that admirable maſter of mechanikes) made to shew the king. All which, depended vpon the rarefaction and condenſation of ſome ſubtile body, conſerued in a cauity within the bulke of the whole inſtrument: for as ſoone as the ſunne shined, they would haue motion and play their partes. And there is no doubt but that grew out of the rarefaction of the ſubtile liquor he made vſe of, which was dilated, as ſoone as the ayre was warmed by the ſunne beames. Of whoſe operation, it was ſo ſenſible, that they no ſooner left the horizon, but its motion ceaſed. And if but a cloude came betweene the inſtrument and them, the muſike would preſently goe ſlower time. And the antient miracle of Memnons ſtatue, ſeemeth to be a iuggling of the Æhiopian Prieſts, made by the like inuention.

2. The reaſon why our bodies for the moſt part do not feele the heate of pure light.

But though he and they found ſome ſpirituall and refined matter, that would receiue ſuch notable impreſſions, from ſo ſmall alterations of temper. Yet it is no wonder that our groſſe bodies are not ſenſible of them, for we can not feele heate, vnleſſe it be greater then that which is in our ſenſe. And the heate there, muſt be in proportion to the heate of our blood: which is in a high degree of warmeth. And therefore it is very poſſible that an exceeding rarifyed fire, may cauſe a farre leſſe impreſſion of heate then we are able to feele. Conſider, how if you ſett pure ſpiritt of wine on fire, and ſo conuert it into actuall flame; yet it will not burne, nor ſcarce warme your hand: and then, can you expect, that the light of a candle, which filleth a great roome, should burne or warme you as farre as it shineth?

If you would exactly know what degree of heate, and power of burning,

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burning, that light hath, which (for example) shineth vpon the wall in a great chamber, in the middest whereof there standeth a candle: doe but calculate, what ouerproportion of quantity all the light in the whole roome beareth, to the quantity of the litle flame att the toppe of the candle; and that is the ouerproportion of the force of burning which is in the candle, to the force of burning which is in so much light att the wall as in extension is equall to the flame of the candle. Which when you haue considered you will not quarrell att its not warming you att that distance; although you grant it to be fire, streaming out from the flame as from the spring that feedeth it, and extremely dilated (according to the nature of fire, when it is att liberty) by going so farre, without any other grosse body to impriſon or clogge it.

It is manifest, that this rule of examining the proportion of burning in so much of the light, as the flame is, (by calculating the proportion of the quantity or extension of all the light in the roome to the extension of the flame of the candle, and then comparing the flame of the candle, to a part of light equall in extension vnto it) is a good and infallible one, if we abstract from accidentall inequalities: since, both the light and the flame, are in a perpetuall fluxe; and all the light, was first in the flame; which is the spring, from whence it continually floweth. As in a riuer wherein euery part runneth with a settled streame; though one place be straighter, and an other broader; yet of necessity, since all the water that is in the broad place came out of the narrow; it must follow that in equall portions of time there is no more water, where it hath the liberty of a large channell, then where the bankes presse it into a narrower bed, so that there be no inequalities in the bottome.

In like manner, if in a large stoue, a basen of water be conuerted into steame; that rarifyed water which then filleth the whole stoue, is no more then what the basen contained before: and consequently, the power of moistening which is in a footes extension (for example) of the stoue wherein that steame is, must be in proportion to the vertue of wetting in the footes extension of water; as the quantity of that great roome which the steame filleth, is to the quantity of the water contained in the basin: for although the rarifyed water be not in euery least part of that great place it seemeth to take vp; by reason that there is ayre, in which it must swimme. Yet the power of wetting that was in the basin of water, is dilated through the whole roome, by the coniunction of the miste or dew to all the sensible partes of the ayre that is in the roome: and consequently the power of wetting, which is in any foote of that roome, is in a manner as much lesse then the power of wetting which was in the foote of water, as if the water were rarifyed to the quantity of the whole roome, and no ayre were left with it.

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And in the same manner, it fareth with dilated fire, as it doth with dilated water: with onely this difference peraduenture that fire groweth purer, and more towardes its owne nature by dilatation; whereas water becometh more mixed and is carried from its nature by suffering the like effect. Yet dilated water will in proportion moisten more then dilated fire will burne: for the rarefaction of water, bringeth it neerer to the nature of ayre (whose chief propriety is moisture,) and the fire that accompanieth it when it raiseth it into steame, giueth it more powerfull ingression into what body it meeteth withall: whereas fire, when it is very pure, and att entire liberty to stretch and spread it selfe as wyde as the nature of it will carry it getteth no aduantage of burning by its mixture with ayre: and allthough it gaineth force by its purity, yet by reason of its extreme rarefaction it must needes be extremely fainte. But if by the helpe of glasses, you will gather into lesse roome that which is diffused into a great one; and so condense it as much as it is (for example) in the flame of a candle; then that fire, or compacted light, will burne much more forcibly then so much flame: for there is as much of it in quantity (excepting what is lost in the carriage of it;) and it is held in together in as litle roome; and it hath this aduantage besides, that it is clogged with no grosse body to hinder the actiuity of it.

3. The experience of burning-glasses, and of soultry gloomy weather proue light to be fire.

It seemeth to me now, that the very answering this obiection, doth (besides repelling the force of it) euidently prooue that light is nothing but fire in his owne nature, and exceedingly dilated: for if you suppose fire, (for example, the flame of a candle) to be stretched out to the vtmost expansion that you may well imagine such a grosse body is capable of; it is impossible it should appeare and worke otherwise, then it doth in light as I haue shewed aboue. And againe, we see plainely, that light gathered together burneth more forcibly then any other fire whatsoeuer, and therefore must needes be fire.

Why then shall we not confidently conclude, that what is fire before it getteth abroade, and is fire againe when it cometh together, doth likewise remaine fire during all its iourney? Nay euen in the iourney it selfe, we haue particular testimony that it is fire: for light returning backe from the earth charged with litle atomes (as it doth in soultry gloomy weather) heateth much more then before; iust as fire doth, when it is imprisoned in a dense body.

4. Philosophers ought not to iudge of thinges by the rules of vulgar people.

Philosophers ought not to iudge by the same rules that the common people doth. Their grosse sense, is all their guide: and therefore they can not apprehend any thing to be fire, that doth not make it selfe be knowne for such by burning them. But he that iudiciously examineth the matter; and traceth the pedigree and periode of it; and seeth the reason why in some circumstances it burneth, and in others it doth not; is too blame, if he suffer himselfe to be led by others ignorance, contrary to his owne reason. When they that

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are curious in perfumes, will haue their chamber filled with a good sent in a hoat seaſon, that agreeth not with burning perfumes, and therefore make ſome odoriferous water be blowne about it by their ſeruants mouthes that are dexterous in that Miniſtery, (as is vſed in Spaine in the ſummer time;) euery one that ſeeth it done, though on a ſuddaine the water be loſt to his eyes and touch, and is onely diſcernable by his noſe; yet he is well ſatisfyed that the ſent which recreateth him, is the very water he ſaw in the glaſſe extremely dilated by the forcible ſprouting of it out from the ſeruants mouth, and will by litle and litle fall downe and become againe palpable water as it was before; and therefore doubteth not but it is ſtill water whiles it hangeth in the ayre diuided into litle atomes. Whereas one that ſaw not the beginning of this operation by water, nor obſerued how in the end it sheweth it ſelfe againe in water; might the better be excuſed, if he should not thinke that what he ſmelled were water blowne about the ayre, nor any ſubſtance of it ſelfe (becauſe he neither ſeeth nor handleth it) but ſome aduentitious quality he knoweth not how adhering to the ayre. The like difference is betweene Philoſophers that proceede orderly in their diſcourſes, and others that pay themſelues with termes which they vnderſtand not. The one, ſee euidence in what they conclude; whiles the others gueſſe wildely att randome.

5. The different names of light and fire proceede from different notions of the ſame ſubſtance.

I hope the Reader will not deeme it time loſt from our maine drift, which we take vp thus in examples and digreſſions: for if I be not much deceiued, they ſerue exceedingly to illuſtrate the matter: which I hope I haue now rendred ſo plaine, as no man that shall haue well weighed it, will expect that fire dilated into that rarifyed ſubſtance which mankind (who according to the different appearance of thinges to their ſenſe, giueth different names vnto them) calleth light, should burne like that groſſer ſubſtance which from doing ſo they call fire; nor doubt but that they may be the ſame thing more or leſſe attenuated; as leafe gold, that flyeth in the ayre as light as downe, is as truly gold as that in an ingott which being heauier then any other ſubſtance falleth moſt forcibly vnto the ground.

What we haue ſaid of the vnburning fire (which we call light) ſtreaming from the flame of a candle; may eaſily be applyed to all other lights depriued of ſenſible heat, whereof ſome appeare with flame, others without it: of the firſt ſort of which, are the innoxious flames that are often ſeene on the haire of mens heads, and horſes manes, on the maſtes of shippes, ouer graues, and fatt marish groundes, and the like: and of the latter ſort, are glow wormes, and the light conſeruing ſtones, rotten wood, ſome kindes of fish and of flesh when they begin to putrify, and ſome other thinges of the like nature.

Now to anſwere the ſecond part of this obiection, that we dayly

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6. ſee great heates without any light, as well as much light without any heat, and therefore light and fire can not be the ſame thing: you may call to mind, how denſe bodies are capable of great quantities of rare ones; and thereby, it cometh to paſſe that bodies which repugne to the dilatation of flame, may neuertheleſſe haue much fire encloſed in them. As in a ſtoue; let the fire be neuer ſo great, yet it appeareth not outwardes to the ſight, although that ſtoue warme all the roomes neere it. So when many litle partes of heate are impriſoned in as many litle celles of groſſe earthy ſubſtance, (which are like ſo many litle ſtoues to them) that impriſonement will not hinder them from being very hoat to the ſenſe of feeling (which is moſt perceptible of denſe thinges.) But becauſe they are choaked with the cloſeneſſe of the groſſe matter wherein they are encloſed, they can not breake out into a body of flame or light, ſo to diſcouer their nature: which (as we haue ſaid before) is the moſt vnfitt way for burning; for we ſee that light muſt be condenſed, to produce flame and fire; as flame muſt be, to burne violently.

The reaſon why many times fire, and heate are depriued of light.

7. Hauing thus cleared the third obiection, (as I conceiue;) lett vs goe on to the fourth; which requireth that we ſatisfy their inquiſition, who aske what becometh of that vaſt body of ſhining light (if it be a body) that filleth all the diſtance betweene heauen and earth; and vanisheth in a moment, as ſoone as a cloude or the moone interpoſeth it ſelfe betweene the ſunne and vs; or that the ſunne quitteth our hemiſphere? No ſigne att all remaineth of it after the extinction of it, as doth of all other ſubſtances; whoſe deſtruction, is the birth of ſome new thing. Whither then is it flowne? We may be perſuaded that a miſt is a corporeall ſubſtance, becauſe it turneth to droppes of water vpon the twigges that it enuironeth: and ſo we might beleeue light to be fire, if after the burning of it out, we found any ashes remaining: but experience aſſureth vs, that after it is extinguished, it leaueth not the leaſt veſtigium behind it of hauing beene there.

What becometh of the body of light, when it dyeth.

Now, before we anſwere this obiection, we will entreate our aduerſary to call to minde, how we haue in our ſolution of the former, declared and proued that the light which (for example) shineth from a candle, is no more then the flame is, from whence it ſpringeth, the one being condenſed, and the other dilated;) and that the flame is in a perpetuall fluxe of conſumption about the circumference, and of reſtauration att the center, where it ſucketh in the fewell: and then, we will enquire of him, what becometh of that body of flame which ſo continually dyeth and is renewed, and leaueth no remainder behind it; as well as he doth of vs, what becometh of our body of light, which in like manner is alwayes dying and alwayes ſpringing fresh? And when he hath well conſidered it, he will find that one anſwere will ſerue for both.

Which is: that as the fire ſtreameth out from the fountaine of it,

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and groweth more ſubtile by its dilatation, it ſinketh the more eaſily into thoſe bodies it meeteth withall: the firſt of which, and that enuironeth it round about, is ayre. With ayre then, it mingleth and incorporateth it ſelfe; and by conſequence, with the other litle bodies that are mingled with the ayre: and in them, it receiueth the changes which nature worketh; by which, it may be turned into the other Elements, if there be occaſion; or be ſtill conſerued in bodies that require heate.

8. An experiment of ſome who pretend, that light may be precipitated into pouder.

Vpon this occaſion, I remember a rare experiment that a noble man of much ſincerity, and a ſingular frind of mine, told me he had ſeene: which was, that by meanes of glaſſes made in a very particular manner, and artificially placed one by an other, he had ſeene the ſunne beames gathered together, and precipitated downe into a brownish or purplish red pouder. There could be no fallacy in this operation: for nothing whatſoeuer, was in the glaſſes when they were placed and diſpoſed for this intent: and it muſt be in the hoat time of the yeare; elſe the effect would not follow. And of this Magiſtery, he could gather ſome dayes, neere two ounces in a day. And it was of a ſtrange volatile nature: and would pierce and imprint his ſpirituall quality into gold it ſelfe (the heauieſt and moſt fixed body we conuerſe withall) in a very short time. If this be plainely ſo, without any miſtaking; then, mens eyes and handes may tell them what becometh of light when it dyeth, if a great deale of it were ſwept together. But from what cauſe ſoeuer this experience had its effect, our reaſon may be ſatisfyed with what we haue ſaid aboue: for I confeſſe, for my part, I beleeue the appearing body might be ſome thing that came along with the ſunne beames, and was gathered by them; but not their pure ſubſtance.

9. The Authors opinion concerning lampes, pretended to haue been found in tombes, with inconſumptible lights.

Some peraduenture will obiect thoſe lampes, which both auncient and moderne writers haue reported to haue been found in tombes and vrnes, long time before cloſed vp from mens repayre vnto them to ſupply them with new fewell: and therefore they beleeue ſuch fires to feede vpon nothing; and conſequently, to be inconſumptible and perpetuall. Which if they be, then our doctrine that will haue light to be nothing but the body of fire perpetually flowing from its center, and perpetually dying; can not be ſound: for in time, ſuch fires would neceſſarily ſpend themſelues in light: although light be ſo ſubtile a ſubſtance that an exceeding litle quantity of fewell, may be dilated into a vaſt quantity of light. Yet ſtill there would be ſome conſumption; which how imperceptible ſoeuer in a short time, yet after a multitude of reuolutions of yeares, it muſt needes diſcouer it ſelfe.

To this I anſwere: that for the moſt part, the wittneſſes who teſtify originally the ſtories of theſe lights, are ſuch as a rationall man can not expect from them that exactneſſe or nicety of obſeruation,

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which is requisite for our purpose; for they are vsually, grosse labouring people, who as they digge the ground for other intentions, do stumble vpon these lampes by chance before they are aware: and for the most part, they breake them in the finding; and they imagine they see a glimpse of light, which vanisheth before they can in a manner take notice of it; and is peraduanture but the glistering of the broken glasse or glased pott, which reflecteth the outward light as soone as by rummaging in the ground and discouering the glasse, the light striketh vpon it; (in such manner as some times a diamond by a certaine encountring of light in a dusky place, may in the first twincling of the motion, seeme to sparkle like fire:) and afterwardes, when they shew their broken lampe, and tell their tale to some man of a pitch of witt aboue them, who is curious to informe himselfe of all the circumstances that may concerne such lights; they straine their memory to answere him satisfactorily vnto all his demandes: and thus, for his sake they persuade themselues to remember what they neuer saw. And he againe on his side, is willing to helpe out the story a litle. And so, after awhile, a very formall and particular relation is made of it. As happeneth in like sort, in reporting of all strange and vnusuall thinges: which, euen those that in their nature abhorre from lying, are naturally apt to straine a litle and fashion vp in a handsome mould; and almost to persuade themselues they saw more then they did: so innate it is vnto euery man, to desire the hauing of some preeminence beyond his neighbours; be it but in pretending to haue seene some thing which they haue not.

Therefore, before I engage my selfe in giuing any particular answere to this obiection of pretended inconsumptible lights, I would gladly see the effect certainely auerred and vndoubtedly proued: for, the testimonies which Fortunius Licetus produceth (who hath been very diligent in gathering them, and very subtile in discoursing vpon them; and is the exactest author that hath written vpon this subiect) do not seeme vnto mee to make that certainty, which is required for the establishing of a ground in Philosophy. Neuertheless, if there be any certaine experience in this particular, I should thinke that there might be some art by circulation of fewell, to maintaine the same light for a great company of yeares. But I should not easily be persuaded, that eyther flame or light could be made without any manner of consuming the body which serueth them for fewell.

THE

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THE EIGHTH CHAPTER.

An answere to three other obiections formerly proposed, against light being a substance.

HAVING thus defended our selues from their obiections, who would not allow light to be fire; and hauing satisfyed their inquisition, who would know what becometh of it when it dyeth, if it be a body: we will now apply our selues to answere their difficulties, who will not lett it passe for a body, becaus it is in the same place with an other body; as, when the sunnebeames enlighten all the ayre, and when the seuerall lights of two distinct candles are both of them euery where in the same roome. Which is the substance of the second maine obiection.

1. Light is not really in euery part of the roome it enlighteneth, nor filleth entirely any sensible part of it, though it seeme to vs to do so.

This of the iustling of the ayre, is easily answered thus: that the ayre being a very diuisible body, doth without resistance yield as much place as is requisite for light. And that light, though our eyes iudge it diffused euery where, yet is not truly in euery point or atome of ayre: but to make vs see it euery where, it sufficeth that it be in euery part of the ayre which is as bigge as the blacke or sight of our eye; so that we can not sett our eye in any position where it receiueth not impressions of light. In the same manner as perfumes: which though they be so grosse bodies that they may be sensibly wafted by the wind; neuertheless, they do so fill the ayre, that we can putt our nose in no part of the roome, where a perfume is burned, but we shall smell it. And the like is of mistes; as also of the sprouted water to make a perfume, which we mentioned aboue.

But becaus pure discourses, in such small thriddes as these, do but weakly bind such readers as are not accustomed vnto them; and that I woudl (if it be possible) render this treatise intelligible to euery rationall man, how euer litle versed in scholastike learning (among whom I expect it will haue a fairer passage, then among those that are already deepely imbued with other principles:) lett vs try if we can herein informe our selues by our sense, and bring our eyes for witnesse of what we say. He then that is desirous to satisfy himselfe in this particular; may putt himselfe in a darke roome, through which the sunne sendeth his beames by a cranie or litle hole in the wall; and he will discouer a multitude of litle atomes flying about in that litle streame of light; which his eye can not discerne, when he is enuironed on all sides with a full light. Then lett him examine, whether or no there be light in the middest of those litle bodies: and his owne reason will easily tell him, that if those bodies were as perspicuous as the ayre, they would not reflect vpon our eyes, the beames by

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which wee ſee them. And therefore, he will boldly conclude, that att the leaſt ſuch partes of them as reflect light vnto vs, do not admitt it, nor lett it ſinke into them. Then let him conſider the multitude of them; and the litle diſtance betwixt one an other; and how neuertheleſſe they hinder not our ſight; but we haue it free to diſcouer all obiects beyond them, in what poſition ſoeuer we place our eye: and when he thus perceiueth that theſe opacous bodies, which are euery where, do not hinder the eye from iudging light to haue an equall plenary diffuſion through the whole place that it irradiateth; he can haue no difficulty to allow ayre, (that is diaphanous, and more ſubtile farre then they, and conſequently, diuiſible into leſſer atomes, and hauing leſſer pores, giueth leſſe ſcope vnto our eyes to miſſe light, then they do) to be euery where mingled with light, though we ſee nothing but light, and can not diſcerne any breach or diuiſion of it.

Eſpecially, when he shall adde vnto this conſideration; that the ſubtile body which thus filleth the ayre, is the moſt viſible thing in the world; and that, whereby all other thinges are ſeene: and that the ayre which it mingleth it ſelfe with, is not at all viſible, by reaſon of the extreme diaphaneity of it, and eaſy reception of the light into euery pore of it without any reſiſtance or reflection: and that ſuch is the nature of light, as it eaſily drowneth an obſcure body, if it be not too bigge: and not onely ſuch, but euen other light bodies: for ſo we know as well the fixed ſtarrs as the planets, are concealed from our ſight, by neereneſſe to the ſunne; neither the lightneſſe of the one, nor the bigneſſe of the other, preuailing againſt the darkening of an exuperant light: and we haue dayly experience of the ſame, in very pure chryſtall glaſſes, and in very cleare water; which though we can not diſcerne by our ſight, if they be in certaine poſitions; neuertheleſſe, by experience we find that they reflect much light, and conſequently haue great ſtore of opacous partes: and then he can not chooſe but conclude, that it is impoſſible, but light should appeare as it doth, to be euery where, and to be one continued thing; though his diſcourſe withall aſſure him it is euery where mingled with ayre.

2. The leaſt ſenſible poynt of a diaphanous body, hath roome ſufficient to containe both ayre and light, together with a multitude of beames iſſuing from ſeuerall lights, without penetrating one an other.

And this very anſwere I thinke will draw with it by conſequence, the ſolution of the other part of the ſame obiection; which is, of many lights ioyning in the ſame place; and the ſame is likewiſe, concerning the images of colours euery where croſſing one an other without hinderance. But to raiſe this contemplation a ſtraine higher; lett vs conſider, how light being the moſt rare of all knowne bodies, is of its owne nature (by reaſon of the diuiſibility that followeth rarity) diuiſible into leſſer partes then any other; and particularly then flame; which being mixed with ſmoake and other corpulency, falleth very short of light. And this, to the proportion in which it is more rare then the body it is compared vnto. Now a great Mathematician

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matician hauing deuiſed how to meaſure the rarefaction of gunne- Willebrord Snell.
powder into flame, found the diameter 50 times encreaſed; and ſo concluded, that the body of the flame, was in proportion to the body of the gunnepowder it was made of, as 125000 is to one. Wherefore, by the immediately proceeding conſequence, we find that 125000 partes of flame may be couched in the roome of one leaſt part of gunnepowder, and peraduenture, many more, conſidering how porous a body gunnepowder is. Which being admitted, it is euident that although light were as groſſe as the flame of gunnepowder, and gunnepowder were as ſolide as gold; yet there might paſſe 125000 rayes of light, in the ſpace wherein one leaſt part of gunnepowder might be contained: which ſpace, would be abſolutely inuiſible vnto vs, and be contained many times in the bigneſſe of the ſight of a mans eye. Out of which we may gather what an infinity of obiects may ſeeme vnto vs to croſſe themſelues in the ſame indiuiſible place, and yet may haue roome ſufficient for euery one to paſſe his way, without hindering his fellow. Wherefore, ſeeing that one ſingle light could not ſend rayes enough to fill euery litle ſpace of ayre that is capable of light, (and the leſſe, the further it is from the flame) it is obuious enough to conceiue, how in the ſpace where the ayre is, there is capacity for the rayes of many candles.

Which being well ſummed vp will take away the great admiration how the beames of light, though they be corporeall, can in ſuch great multitudes, without hindering one an other, enter into bodies and come to our eye: and will ſhew, that it is the narrowneſſe of our capacities, and not the defect of nature, which maketh theſe difficulties ſeeme ſo great; for ſhe hath ſufficiently prouided for all theſe ſubtile operations of fire; as alſo for the entrance of it into glaſſe, and into all other ſolide bodies that are diaphanous (vpon which was grounded the laſt inſtance the ſecond obiection preſſed:) for all ſuch bodies being conſtituted by the operation of fire (which is alwayes in motion) there muſt needes be wayes left for it both to enter in and to euaporate out. And this is moſt euident in glaſſe which being wrought by an extreme violent fire and ſwelling with it, as water and other thinges do by the mixture of fire; muſt neceſſarily haue great ſtore of fire in it ſelfe whiles it is boyling; as we ſee by its being red hoat. And hence it is, that the workemen are forced to lett it coole by degrees in ſuch relentinges of fire as they call their nealing heates; leaſt it ſhould shiuer in pieces by a violent ſucceeding of ayre in the roome of the fire; for that being of greater partes then the fire, would ſtraine the pores of the glaſſe too ſoddainly, and breake it all in pieces to gett ingreſſion: whereas in thoſe nealing heates the ayre being rarer, leſſer partes of it ſucceede to the fire, and leiſurely ſtretch the pores without hurt. And therefore we neede not wonder that light paſſeth ſo eaſily through glaſſe; and much leſſe, that it

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getteth through other bodies; seeing, the experience of Alchymistes doth assure vs that it is hard to find any other body so impenetrable as glasse.

3. That light doth not enlighten any roome in an instant; and that the great celerity of its motion doth make it imperceptible to our senses.

But now to come to the answere of the first, and in appearance most powerfull obiection against the corporeity of light; which vrgeth that his motion is performed in an instant, and therefore can not belong to what is materiall and clothed with quantity. Wee will endeauour to shew how vnable the sense is to iudge of sundry sortes of motions of Bodies, and how grossely it is mistaken in them. And then, when it shall appeare that the motion of light must necessarily be harder to be obserued then those others: I conceiue, all that is raised against our opinion by so incompetent a iudge, will fall flatt to the ground.

First then, lett mee putt the reader in minde, how if euer he marked children when they play with firestickes, they mooue and whirle them round so fast, that the motion will cosen their eyes, and represent an entire circle of fire vnto them: and were it somewhat distant, in a darke night, that one played so with a lighted torch, it would appeare a constant wheele of fire without any discerning of motion in it. And then, lett him consider how slow a motion that is in respect of what it is possible a body may participate of: and he may safely conclude, that it is no wonder though the motion of light be not descryed, and that indeede no argument can be made from thence to prooue that light is not a body.

But lett vs examine this consideration a litle further, and compare it to the motion of the earth or heauens: lett the appearing circle of the fire, be some three foote diameter, and the time of one entire circulation of it, be the sixtieth part of a minute; of which minutes, there are 60. in an houre; so that in a whole day, there will be but 86400. of these partes of time. Now the diameter of the wheele of fire being but of three foote, the whole quantity of space that it mooueth in that atome of time will be att the most 10. foote; which is three paces and a foote: of which partes, there are neere eleuen millions in the compasse of the earth: so that if the earth be mooued round in 24. houres, it must go neere 130. times as fast as the boyes sticke doth, which by its swift motion deceiueth our eye. But if we allow the sunne, the moone, and the fixed starrs to moue; how extreme swift must their flight be, and how imperceptible would their motion be in such a compasse as our sight would reach vnto? And this being certaine, that whether the earth or they do moue, the appearances to vs are the same; it is euident, that as now they can not be perceiued to moue (as peraduenture they do not;) so it would be the very same in shew to vs, although they did moue. If the

sunne

ſunne were neere vs, and galloped at that rate; ſurely we could not diſtinguish betweene the beginning and ending of his race: but there would appeare one permanent line of light from Eaſt to Weſt, without any motion att all: as the torch ſeemeth to make, with ſo much a ſlower motion, one permanent immooueable wheele of fire.

But contrary to this effect, we ſee that the ſunne and ſtarrs by onely being remooued further from our eyes, do coſen our ſight ſo groſſely that we can not diſcerne them to be mooued att all. One would imagine that ſo rapide and ſwift a motion, should be perceiued in ſome ſort or other, (which, whether it be in the earth, or in them, is all one to this purpoſe.) Eyther we should ſee them change their places whiles we looke vpon them, as arrowes and birdes do when they fly in the ayre: or elſe, they should make a ſtreame of light bigger then themſelues, as the torch doth. But none of all this happeneth: lett vs gaze vpon them ſo long and ſo attentiuely that our eyes be dazeled with looking, and all that while they ſeeme to ſtand immooueable: and our eyes can giue vs no account of their iourney till it be ended. They diſcerne it not whiles it is in doing: ſo that if we conſult with no better cownſailour then them, we may wonder to ſee that body at night ſetting in the Weſt, which in the morning we beheld riſing in the Eaſt.

But that which ſeemeth to be yett more ſtrange, is, that theſe bodies mooue croſſe vs, and neuertheleſſe are not perceiued to haue any motion att all. Conſider then how much eaſier it is for a thing that mooueth towardes vs, to be with vs before we are aware. A nimble fencer will put in a thruſt ſo quicke, that the foile will be in your boſome, when you thought it a yard off; becauſe in the ſame moment you ſaw his point ſo farre diſtant, and could not diſcerne it to mooue towards you, till you felt the rude ſalutation it gaue you. If then you will compare the body of light with theſe others that thus deceiue vs in regard of motion; you muſt needes agree it is much rashneſſe to conclude it hath no motion, becauſe we can not diſcerne the ſucceſſion of it. Conſider that it is the ſubtileſt of all the bodies that God hath made. Examine the paths of it, which for the ſmallneſſe of their thriddes, and the extreme diuiſibility of them, and their pliant application of themſelues to whatſoeuer hath pores, are almoſt without reſiſtance. Calculate the ſtrange multiplication of it, by a perpetuall momentary renouation of its ſtreames. And caſt with your ſelfe, with what extreme force it ſpringeth out and flyeth abroad. And on the other ſide, reflect how all theſe thinges are directly oppoſite and contrary in thoſe other great bodies, whoſe motion neuertheleſſe

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appeareth not vnto us till it be done and past. And when you haue well weighed all this; you must needes grant that they who in this case guide themselues meerely by what appeareth vnto their eyes, are ill iudgers of what they haue not well examined.

4. The reason why the motion of light, is not discerned coming towardes vs; and that there is some reall tardity in it.

But peraduenture some who can not all of a soddaine be weaned from what their sense hath so long fed them with; may aske yet further, how it chanceth that we haue no effects of this motion? It sheweth not it selfe in the ayre, coming to us a farre of. It stayeth not a thought, or slackneth his speed in flying so vast a space as is from the sunne to vs. In fine there is no discouery of it.

But if Galileus his conception be well grounded; that lightning giueth vs an incling of its motion, beginning from a litle and encreasing to a greater: or if Monsieur des Cartes his opinion that it goeth slower in refraction, be true: we shall not neede to study long for an answere. But in Galileus his experience, it may be the breaking of the cloude which receiueth that succession of motion which we see: and no slowneſſe that light can acquire by the resistance of the refracting body, can be so greate as to make that difference of lines which Monsieur Des Cartes most ingeniously (though I much doubt not truly) hath applyed to yield the reason of refraction: as will appeare in our further discourse.

Therefore, these being vncertaine; we will, to shew the vnreasonableneſſe of this question, suppose there may be some obseruable tardity in the motion of light; and then aske of them, how we should arriue to perceiue it? What sense should we employ in this discouery? It is true, we are satisfyed that sound taketh vp time in coming to our eares: but it is, becausе our eyes are nimbler then they, and can perceiue a good way distant the carpenters axe falling vpon the timber that he heweth, or the fire flashing out of the canon, before they heare any newes of them: but shutt your eyes; or enquire of a blind man; and then neither you nor he can tell whether those soundes fill your eares att the very instant they were begotten, or haue spent some time in their iourney to you. Thus then our eyes instruct our eares. But is there any sense quicker then the sight? or meanes to know speedier then by our eyes? Or can they see light, or any thing else; vntill it be with them? We may then assuredly conclude, that its motion is not to be discerned as it cometh vpon vs; nor it selfe to be perceiued, till its beames are in our eyes.

But if there were any meanes to discouer its motion, surely it must be in some medium, through which it must struggle to gett, as fire doth through iron; which encreasing there by degrees, att last (when it is red hoat) sendeth beames of light quite through the plate that att the first refused them passage. And it

maketh

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maketh to this purpoſe, that the lightconſeruing ſtones which are gathered in Italy, muſt bee ſett in the ſunne for ſome while before they retaine light: and the light will appeare in them when they are brought backe into the darke, greater or leſſer (vntill they come to their vtmoſt periode) according as they haue beene longer or a leſſer while in the ſunne. And our eyes the longer they remaine in the light, the more dazeled they are if they be ſuddainely paſſed into the darke. And a curious experiencer did affirme, that the likeneſſe of any obiect (but particularly he had often obſerued it of an iron grate) if it be ſtrongly enlightened will appeare to an other, in the eye of him that looketh ſtrongly and ſteadily vpon it till he be dazeled by it; euen after he shall haue turned his eyes from it. And the wheele of fire could neuer be made appeare vnto our eye by the whirling of the fireſticke we euen now ſpoke of; vnleſſe the impreſſion made by the fire from one place, did remaine in the eye a while after the fire was gone from the place whence it ſent that ray. Whence it is euident, that light, and the pictures of obiects, do require time to ſettle and to vnſettle in a ſubiect. If then light maketh a greater impreſſion with time, why should we doubt but the firſt cometh alſo in time; were our ſenſe ſo nimble as to perceiue it?

5. The planets are not certainely euer in that place where they appeare to be.

But then it may be obiected, that the ſunne would neuer be truly in that place in which vnto our eyes it appeareth to be: becauſe that, it being ſeene by meanes of the light which iſſueth from it; if that light required time to moue in, the ſunne (whoſe motion is ſo ſwift) would be remooued from the place where the light left it, before it could be with vs to giue tidinges of him. To this I anſwere, allowing that peraduenture it may be ſo. Who knoweth the contrary? Or what inconuenience would follow, if it be admitted? Indeed, how can it be otherwiſe? In refraction, we are ſure it is ſo: and therefore att no time but when the ſunne is perpendicularly ouer our heades, we can be certaine of the contrary allthough it should ſend its light to vs in an inſtant. Vnleſſe happily the truth of the caſe should be, that the ſunne doth not mooue about vs; but we turne to his light: and then, the obiection alſo looſeth its ayme.

6. The reaſon why light being a body, doth not by its motion shatter other bodies into pieces.

But the more we preſſe the quickneſſe of light; the more we engage our ſelues in the difficulty why light doth not shatter the ayre in pieces, as likewiſe all ſolide bodies whatſoeuer: for the maſters of naturall Philoſophy do tell vs, that a ſofter thing with a great velocity, is as powerfull in effect when it giueth a blow, as a harder thing going ſlowly. And accordingly experience teacheth vs, that a tallow candle shott in gunne, will goe through a borad or kill aman. Wherefore light hauing ſuch an infinite celerity, should alſo haue an vnreſiſtable force, to pierce and shatter, not onely the ayre, but euen the hardeſt bodies that are. Peraduenture ſome may thinke it reaſonable to

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grant the consequence (in due circumstances) since experience teacheth vs that the congregation of a litle light by a glasse, will sett very solide bodies on fire, and will melt mettals in a very short space; which sheweth a great actiuity; and the great actiuity sheweth a great percussion, burning being effected by a kind of attrition of the thing burned. And the great force which fire sheweth in gunnes and in mines, being but a multiplication of the same, doth euidently conuince that of its owne nature, it maketh a strong percussion, when all due circumstances concurre. Whereas it hath but litle effect, if the due circumstances be wanting; as we may obserue in the insensible burning of so rarifyed a body as pure spiritt of wine conuerted into flame.

But we must examine the matter more particularly, and must seeke the cause why a violent effect doth not alwayes appeare, whersoeuer light striketh; for the which wee are to note that three thinges do concurre to make a percussion great. The bigness, the density and the celerity of the body mooued. Of which three, there is only one in light; to witt, celerity: for it hath the greatest rarity, and the rayes of it are the smallest parcels, of all naturall bodies. And therefore since only celerity is considerable in the account of lights percussions, we must examine what celerity is necessary to make the stroke of a ray sensible: first then we see that all the motes of the ayre, nay euen feathers and strawes, do make no sensible percussion when they fall vpon vs: therefore we must in light haue att the least a celerity that may be to the celerity of the straw falling vpon our hand (for example,) as the density of the straw is to the density of light, that the percussion of light may be in the least degree sensible. But lett vs take a corne of gunnepowder insteede of a straw (betweene which there can not be much difference) and then putting that the density of fire, is to the density of gunnepowder as 1. to 125000; and that the density of the light we haue here in the earth, is to the density of that part of fire which is in the sunnes body, as the body of the sunne is to that body which is called *Orbis magnus*, (whose semidiameter is the distance betweene the sunne and the earth;) which must be in subtriple proportion of the diameter of the sunne to the diameter of the great orbe: it followeth that 125000. being multiplyed by the proportion of the great orbe vnto the sunne (which Galileo telleth vs is as 106000000. vnto one) will giue a scantling of what degree of celerity light must haue more then a corne of gunnepouder, to recompence the excesse of weight which is in a corne of gunnepouder, aboue that which is in a ray of light, as bigge as a corne of gunnepouder. Which will amount to be much greater then the proportion of the semidiater of *Orbis magnus*, to the semidiater of the corne of gunnepouder: for if you reckon 5. graines of gunnepouder to a barley cornes breadth, and 12. of them in an inch, and 12. inches in a foote, and 3. feete in a pace, and 1000. paces in a mile, and 3500. miles in the semidiameter of the earth, and 1208. semidiameters of the earth, in the semidiameter of the *Orbis*

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magnus, there will be in it but 913248000000. graines of gunnepouder; whereas the other calculation maketh light to be 1325000000000. times raver then gunnepouder; which is almoſt tenne times a greater proportion then the other. And yet this celerity ſupplyeth but one of the two conditions wanting in light to make its percuſſions ſenſible, namely denſity. Now becauſe the ſame velocity, in a body of a leſſer bulke, doth not make ſo great a percuſſion as it doth in a bigger body; and that the littleneſſe of the leaſt partes of bodies followeth the proportion of their rarity: this vaſt proportion of celerity muſt againe be drawne into it ſelfe, to ſupply for the exceſſe in bigneſſe that a corne of gunnepouder hath ouer an atome of light: and the product of this multiplication will be the celerity required to ſupply for both defects. Which euidently sheweth, it is impoſſible that a ray of light should make any ſenſible percuſſion, though it be a body. Eſpecially conſidering that ſenſe neuer taketh notice of what is perpetually done in a moderate degree. And therefore, after this minute looking into all circumſtances, we neede not haue difficulty in allowing vnto light the greateſt celerity imaginable, and a percuſſion proportionate to ſuch a celerity in ſo rare a body; and yett not feare any violent effect from its blowes: vnleſſe it be condenſed, and many partes of it be brought together to worke as if they were but one.

7. The reaſon why the body of light is neuer perceiued to be fanned by the wind.

As concerning the laſt obiection; that if light were a body, it would be fanned by the wind: wee muſt firſt conſider what is the cauſe of a thinges appearing to be mooued: and then examine what force that cauſe hath in light. As for the firſt part; we ſee that when a body is diſcerned now in one place, now in an other, then it appeareth te be mooued. And this we ſee happeneth alſo in light; as when the ſunne or a candle is carried or mooueth, the light thereof in the body of the candle or ſunne ſeemeth to be mooued along with it. And the like is in a shining cloud or comete.

But to apply this to our purpoſe: wee muſt note that the intention of the obiection is, that the light which goeth from the fire to an opacous body farre diſtant without interruption of its continuity, should ſeeme to be iogged or putt out of its way, by the wind that croſſeth it. Wherein the firſt fayling is, that the obiectour conceiueth light to ſend ſpecies vnto our eye from the middeſt of its line: whereas with a litle conſideration he may perceiue, that no light is ſeene by vs but that which is reflected from an opacous body to our eye: ſo that the light he meaneth in his obiection, is neuer ſeene att all. Secondly; it is manifeſt that the light which ſtricketh our eye, doth ſtrike it in a ſtraight line; and ſeemeth to be att the end of that ſtraight line, whereſoeur that is; and ſo can neuer appeare to be in an other place: but the light which wee ſee in an other place, we conceiue to be an other light. Which maketh it againe euident, that the light can neuer appeare to shake, though wee should ſuppoſe that light may be ſeene from the middle of its line; for no part of wind or ayre can come into any ſenſible place in that middle of the line, with

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ſuch ſpeede that new light from the ſource doth not illuminate it ſooner then it can be ſeene by vs: wherefore it will appeare to vs illuminated as being in that place: and therefore, the light can neuer appeare shaken. And laſtly, it is eaſier for the ayre or wind to deſtroy the light, then it is to remooue it out of its place: wherefore, it can neuer ſo remoue it out of its place, as that we should ſee it in an other place. But if it should remooue it, it would wrappe it vp within it ſelfe and hide it.

8. The reaſons, for and againſt lights being a body, compared together.

In concluſion; after this long diſpute concerning the nature of light: if we conſider well what hath beene ſaid on both ſides (to which much more might be added, but that we haue already treſpaſſed in length, and I conceiue, enough is ſaid to decide the matter) an equall iudge will find the ballance of the queſtion to hang vpon theſe termes: that, to proue the nature of light to be materiall and corporeall, are brought a company of accidents well knowne to be the proprieties of quantity or bodies; and as well knowne to be in light. Euen ſo farre as that it is manifeſt, that light in its begining before it be diſperſed, is fire; and if againe it be gathered together, it sheweth it ſelfe againe to be fire. And the receptacles of it, are the receptacles of a body: being a multitude of pores; as the hardneſſe and coldneſſe of tranſparent thinges, do giue vs to vnderſtand; of which we shall hereafter haue occaſion to diſcourſe.

On the contrary ſide, whatſoeuer arguments are brought againſt lights being a body, are onely negatiues. As, that we ſee not any motion of light; that we do not diſcerne, where the confines are betweene light and ayre; that we ſee not roome for both of them, or for more lights to be together; and the like: which is to oppoſe negatiue proofes againſt affirmatiue ones; and to build a doctrine vpon the defect of our ſenſes; or vpon the likeneſſe of bodies which are extremely vnlike, expecting the ſame effects from the moſt ſubtile as from the moſt groſſe ones. All which, together with the autority of Ariſtotle and his followers, haue turned light into darkneſſe, and haue made vs almoſt deny the light of our owne eyes.

9. A ſummary repetition of the reaſons, which proue that light is fire.

Now then, to take our leaue of this important queſtion: lett vs returne to the principles from whence we began, and conſider; that ſeeing fire is the moſt rare of all the Elements, and very dry: and that out of the former it hath that it may be cutt into very ſmall pieces; and out of the latter, that it conſerueth its owne figure, and ſo is apt to diuide, whatſoeuer fluide body: and ioyning to theſe two principles, that it multiplyeth extremely in its ſource. It muſt of neceſſity follow that it shooteth out in great multitudes, litle ſmall partes into the ayre and into other bodies circũfuſed, with great dilatation, in a ſpherical manner. And likewiſe that theſe litle partes are eaſily broken; and new ones, ſtill following the former, are ſtill multiplyed in ſtraight lines from the place where they breake. Out of which it is euident, that

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that of neceſſity it muſt in a manner fill all places; and that no ſenſible place is ſo litle, but that fire will be found in it, if the medium be capacious. As alſo, that its extreme leaſt partes will be very eaſily ſwallowed vp in the partes of the ayre, which are humide; and by their enfolding, be as it were quite loſt; ſo as to looſe the appearance of fire. Againe; that in its reflections, it will follow the nature of groſſer bodies, and haue glidinges like them; which is that, we call refractions. That, litle ſtreaminges from it will croſſe one an other in exceſſiue great numbers, in an vnſenſible part of ſpace, without hindering one an other. That its motion will be quicker then ſenſe can iudge of; and therefore, will ſeeme to mooue in an inſtant, or to ſtand ſtill as in a ſtagnation. That if there be any bodies ſo porous with litle and thicke pores; as that the pores arriue neere vnto equalling the ſubſtance of the body; then, ſuch a body will be ſo filled with theſe litle particles of fire, that it will appeare as if there were no ſtoppe in its paſſage, but were all filled with fire; and yet, many of theſe litle partes will be reflected. And whatſoeuer qnalities else we find in light, we shall be able to deriue them out of theſe principles, and shew that fire muſt of neceſſity doe what experience teacheth vs that light doeth. That is to ſay in one word, it will shew vs that fire is light. But if fire be light, then light muſt needes be fire. And ſo we leaue this matter.

THE NINETH CHAPTER.

Of Locall Motion in common.

THOVGH in the fifth chapter, we made onely earth the pretender in the controuerſy againſt fire for ſuperiority in actiuity; (and in very truth, the greateſt force of grauity doth appeare in thoſe bodies which are eminently earthy:) neuertheleſſe, both water and ayre (as appeareth out of the fourth chapter of the Elements) do agree with earth in hauing grauity. And grauity, is the chiefe vertue to make them efficients. So that vpon the matter, this plea is common to all the three Elements. 1. No locall motion can be performed without ſucceſſion.

Wherefore, to explicate this vertue, whereby theſe three weighty Eleméts do worke; lett vs call to minde what we ſaid in the beginning of the laſt chapter concerning locall motion: to witt that according as the body mooued, or the diuider did more and more enter into the diuided body; ſo, it did ioyne it ſelfe to ſome new partes of the medium or diuided body, and did in like manner forſake others. Whence it happeneth that in euery part of motion, it poſſeſſeth a greater part of the medium then it ſelfe can fill att once. And becauſe by the limitation and confinedneſſe of euery magnitude vnto iuſt

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what it is, and no more; it is impossible that a lesser body should att once equallise a greater. It followeth that this diuision or motion whereby a body attaineth to fill a place bigger then it selfe, must be done successiuely: that is, it must first fill one part of the place it mooueth in, then an other; and so proceede on, till it haue measured it selfe with euery part of the place from the first beginning of the line of motion to the last periode of it where the body resteth.

By which discourse it is euident, that there can not in nature be a strength so great as to make the least or quickest mooueable that is, to passe in an instãt, or all together, ouer the least place that can be imagined: for that would make the mooued body (remaining what it is, in regard of its biggenesse) to equallise ad fitt a thing bigger then it is. Therefore it is manifest, that motion must consist of such partes as haue this nature; that whiles one of them is in being, the others are not yet: and as by degrees euery new one cometh to be; all the others that were before, do vanish and cease to be. Which circumstance accompanying motion, we call succession.

2. Time is the common measure of all succession.

And whatsoeuer is so done, is said to be done *in time*: which is the common measure of all succession, for, the change of situation of the starrs, but especially of the sunne and moone, is obserued more or lesse by all mãkind: and appeareth alike to euery man: and (being the most knowne, constant, and vniforme succession that men are vsed vnto) is as it were by nature it selfe sett in their way and offered vnto them as fittest to estimate and iudge all other particular successions, by comparing them both to it, and among themselues by it. And accordingly we see all men naturally measure all other successions, and expresse their quantities, by comparing them to the reuolutions of the heauens; for dayes, houres, and yeares, are nothing else but they, or some determinate partes of them: vnto some of which, all other motions and successions must of necessity be referred, if we will measure them. And thus we see how all the mystery of applying time vnto particular motions, is nothing else but the considering how farre the Agent that mooueth the sunne, causeth it to go on in its iorney, whiles the Agent that mooueth a particular body, causeth it to performe its motion.

3. What velocity is, and that it can not be infinite.

So that it is euident, that velocity is the effect of the superproportion of the one Agent ouer a certaine medium, in respect of the proportion which an other Agent hath to the same medium. And therefore, velocity is a quality by which one succession is intrinsecally distinguished from an other: though our explication, vseth to include time in the notions of velocity and tardity. Velocity then, is the effect (as we said) of more strength in the Agent. And hauing before expressed, that velocity is a kind of density; wee find that this kind of density is an excellency in succession; as permanent density, is an excellency in the nature of substance, though an imperfection in the nature of quantity (by which we see, that quantity is a kind of base alloy added to substance.) And out of this

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of this it is euident, that by how much the quicker the motion is in equall mediums, by so much the agent is the perfecter which causeth it to be so quicke. Wherefore, if the velocity should ascend so much as to admitt no proportion betweene the quicknesse of the one and the tardity of the other, all other circumstances being euen, excepting the difference of the agents; then there must be no proportion betweene the agents. Nor indeed can there be any proportion betweene them though there were neuer so great differences in other circumstances, as long as those differences be within any proportion. And consequently, you see that if one agent be supposed to mooue in an instant, and an other in time; whatsoeuer other differences be in the bodies mooued and in the mediums; neuertheless the agent which causeth motion in an instant, will be infinite in respect of the agent which mooueth in time. Which is impossible: it being the nature of a body, that greater quantity of the same thing hath greater vertue, then a lesse quantity hath; and therefore, for a body to haue infinite vertue, it must haue infinite magnitude.

If any should say the contrary; affirming that infinite vertue may be in a finite body; I aske, whether in halfe that body (were it diuided) the vertue would be infinite or no? If he acknowledge that it would not; I inferre thence, that neither in the two partes together there can be infinite vertue: for two finites can not compose and make vp one infinite. But if he will haue the vertue be infinite in each halfe, he therein alloweth that there is no more vertue, in the whole body then in one halfe of it: which is against the nature of bodies. Now that a body can not be infinite in greatnesse, is prooued in the second knott of Mr. whites first Dialogue of the world. And thus it is euident, that by the vertue of pure bodies there can be no motion in an instant.

4. No force so litle, that is not able to moue the greatest weight imaginable.

On the other side, it followeth that there can not be so litle a force in nature, but that giuing it time enough, it will mooue the greatest weight that can be imagined: for, the thinges we treate of, being all of them quantities; they may by diuision and multiplication, be brought vnto equality. As for example; supposing the weight of a mooueable, to be a millió of poundes; and that the moouer is able to mooue the millioneth part of one of those poundes, in a million of yeares, the millioneth part of a pace, through a mediũ of a certaine rarity. Now, seeing that yeares may be multiplyed so, as to equalise the force of this moouer, vnto the weight of the mooueable. It followeth cleerely that in so many millions of yeares, this force may mooue the whole weight of a million of poundes, through the determined medium in a determinate number of millions of yeares, a million of paces: for such a force is equall to the required effect; and by consequence, if the effect should not follow, there would be a complete cause putt, and no effect result from it.

But peraduenture it is needfull to illustrate this point yet further: suppose then a weight neuer so great to be A, and a force neuer so litle to be B. Now if you conceiue that some other force mooueth A, you must

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withall conceiue that it mooueth A ſome ſpace, ſince all motion implyeth neceſſarily that it be through ſome ſpace: lett that ſpace be C D. And becauſe a body can not be mooued in a ſpace in an inſtant, but requireth ſome time to haue its motion performed in; it followeth that there muſt be a determined time, in which the conceiued force muſt mooue the weight A through the ſpace C D: lett that time be E F. Now then; this is euident, that it is all one to ſay that B mooueth A, and to ſay that B mooueth A through a ſpace in a time; ſo that if any part of this be left out, it can not be vnderſtood that B mooueth A. Therefore to expreſſe particularly the effect which B is to do vpon A, we muſt ſay that B muſt mooue A a certaine ſpace in a certaine time. Which being ſo we may in the next place conſider that this effect of mooving A may be diminished two wayes, eyther becauſe the ſpace it is to be mooued in, is leſſened; or the time taken vp in its motion, is encreaſed: for, as it is a greater effect, to mooue A through the ſpace C D, in a leſſe time then E F, ſo it is a leſſe effect to moue the ſame A, through the ſpace C D, in a greater time then E F; or through a leſſe ſpace then C D in the time E F. Now then, this being ſuppoſed, that it is a leſſe effect to mooue A through C D, in a greater time then E F, it followeth alſo, that a leſſer vertue is able to mooue it through C D in a greater time then E F, then the vertue which is required to mooue it, through the ſame ſpace in the time E F. Which if it be once granted (as it can not be denyed) then multiplying the time, as much as the vertue or force required to mooue A through C D in the time E F is greater then the force B; in ſo much time, the force B will be able to mooue A through C D. Which diſcourſe is euident, if we take it in the common termes: but if it be applyed to action, wherein phyſicall accidents intervene; the artificer muſt haue the iudgement to prouide for them, according to the nature of his matter.

5. The chiefe principle of Mechanikes deduced out of the former diſcourſe.

Vpon this laſt diſcourſe doth hang the principle which gouerneth Mechanikes, to witt, that the force and the diſtance of weights counterpoiſing one an other, ought to be reciprocall. That is, that by how much the one weight is heauyer then the other, by ſo much muſt the diſtance of the lighter from the fixed point vpon which they are mooued, be greater then the diſtance of the greater weight from the ſame point: for it is plaine that the weight which is more diſtant, muſt be mooued a greater ſpace, then the neerer weight, in the proportion of the two diſtãces. Wherefore, the force mooving it muſt carry it in a velocity of the ſaid proportion to the velocity of the other. And conſequently, the Agent or moouer, muſt be in that proportion more powerfull then the contrary moouer. And out of this practiſe of Geometricians in Mechanikes (which is confirmed by experience) it is made euident that if other conditions be equall, the exceſſe of ſo much grauity will make ſo much velocity. And ſo much velocity in proportion, will recompence ſo much grauity.

Out

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Out of the precedent concluſions, an other followeth: which is, that nothing recedeth frō quiet or reſt, and attaineth a great degree of celerity, but it muſt paſſe through all the degrees of celerity that are below the obtained degree. And the like is, in paſſing from any leſſer degree of velocity vnto a greater: becauſe it muſt paſſe through all the intermediate degrees of velocity. For by the declaration of velocity which we haue euen now made, we ſee that there is as much reſiſtance in the medium to be ouercome with ſpeede, as there is for it to be ouercome in regard of the quantity, or line of extent of it: becauſe (as we haue ſaid) the force of the Agent in counterpoiſes, ought to be encreaſed as much as the line of extent of the medium which is to be ouercome by the Agent in equall time, doth exceede the line of extent of the medium, along which the reſiſtent body is to be mooued. Wherefore, it being prooued that no line of extent, can be ouercome in an inſtant, it followeth that no defect of velocity which requireth as great a ſuperproportion in the cauſe, can be ouercome likewiſe in an inſtant.

6. No moueable can paſſe from reſt to any determinate degree of velocity, or from a leſſer degree to a greater, without paſſing through all the intermediate degrees, which are below the obtained degree.

And by the ſame reaſon by which we prooue that a mooueable can not be drawne in an inſtant from a lower degree of velocity to a higher, it is with no leſſe euidence concluded that no degree of velocity can be attained in an inſtant: for diuide that degree of velocity into two halfes, and if the Agent had ouercome the one halfe, he could not ouercome the other halfe in an inſtant: much leſſe therefore is he able to ouercome the whole (that is, to reduce the mooueable from quiet to the ſaid degree of velocity) in an inſtant.

An other reaſon may be, becauſe the moouers themſelues (ſuch moouers as we treate of here) are bodies likewiſe mooued, and do conſiſt of partes: whereof not euery one part, but a competent number of them, doth make the moouing body to be a fitt Agent able to mooue the propoſed body in a propoſed degree of celerity. Now this Agent meeting with reſiſtance in the mooueable, and not being in the vtmoſt extremity of denſity, but condenſable yet further, (becauſe it is a body;) and that euery reſiſtance (be it neuer ſo ſmall) doth worke ſomething vpon the moouer (though neuer ſo hard) to condenſe it; the partes of the moouer that are to ouercome this reſiſtance in the mooueable, muſt (to worke that effect) be condenſed and brought together as cloſe as is needefull, by this reſiſtance of the mooueable to the moouer; and ſo, the remote partes of the moouer, become neerer to the mooueable, which can not be done but ſucceſſiuely, becauſe it includeth locall motion. And this application being likewiſe diuiſible, and not all the partes flocking together in an inſtant to the place where they are to exerciſe their power; it followeth, that whiles there are fewer moouing partes knitt together, they muſt needes mooue leſſe and more weakely, then when more or all of them are

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assembled and applyed to that worke. So that, the motiue vertue encreasing thus in proportion to the multiplying of the partes applyed to cause the motion; of necessity, the effect (which is obedience to be mooued, and quickness of motion in the mooueable) must do so too: that is, it must from nothing, or from rest, passe through all the degrees of celerity vntill it arriue to that which all the partes together are able to cause.

As for example, when with my hand I strike a ball; till my hand toucheth it, it is in quiet; but then, it beginneth to mooue; yet with such resistance, that although it obey in some measure the stroke of my hand, neuertheless it presseth the yielding flesh of my palme backwardes towardes the vpper and bony part of it. That part then ouertaking the other, by the continued motion of my hand; and both of them ioyning together to force the ball away; the impulse becometh stronger, then att the first touching of it. And the longer it presseth vpon it, the more the partes of my hand do condense and vnite themselues to exercise their force; and the ball therefore must yield the more; and consequently, the motion of it groweth quicker and quicker, till my hand parteth from it. Which condensation of the partes of my hand encreasing successiuely by the partes ioyning closer to one an other, the velocity of the balles motion (which is an effect of it) must also encrease proportionably thereunto. And in like manner, the motion of my hand and arme, must grow quicker and quicker and passe all the degrees of velocity betweene rest and the vtmost degree it attaineth vnto: for seeing they are the spirits swelling the nerues, that cause the armes motion, (as we shall hereafter shew;) vpon its resistance, they flocke from other partes of the body to ouercome that resistance. And since their iourney thither requireth time to performe it in; and that the neerest come first; it must needes follow, that as they grow more and more in number, they must more powerfully ouercome the resistance; and consequently, encrease the velocity of the motion, in the same proportion as they flocke thither; vntill it attaine that degree of velocity, which is the vtmost periode that the power, which the Agent hath to ouercome the resistance of the medium, can bring it selfe vnto. Betweene which and rest, or any inferiour degree of velocity, there may be designed infinite intermediate degrees, proportionable to the infinite diuisibility of time, and space in which the moouer doth moue. Which degrees do arise out of the reciprocall yielding of the medium. And that is likewise diuisible in the same infinite proportion.

Since then, the power of all naturall Agents is limited; the moouer (be it neuer so powerfull) must be confined to obserue these proportions; and can not passe ouer all these infinite designable degrees in an instant; but must allott some time (which hath a like infinity of designable partes) to ballance this infinity of degrees of velocity.

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velocity: and ſo conſequently, it requireth time, to attaine vnto any determinate degree. And therefore can not recede immediately from reſt vnto any degree of celerity; but muſt neceſſarily paſſe through all the intermediate ones.

Thus it is euident that all motion which hath a beginning muſt of neceſſity encreaſe for ſome time. And ſince the workes of nature are in proportion to their cauſes, it followeth that this encreaſe is in a determinate proportion. Which Galileus (vnto whom we owe the greateſt part of what is knowne concerning motion) teacheth vs how to find out; and to diſcouer what degree of celerity any mooueable that is moued by nature, hath in any determinate part of the ſpace it moueth in.

7. The conditions which helpe to motiō, in the moueable are three, in the medium, one.

Hauing ſettled theſe conditions of motion; we shall do well in the next place to enquire after the cauſes of it: as well in the body moued, as alſo in the mouer that occaſioneth the motion. And becauſe we haue already shewed, that locall motion is nothing in ſubſtance but diuiſion: we may determine that thoſe cauſes which contribute to diuiſion, or reſiſt it, are the cauſes which make, or reſiſt locall motion. It hath alſo beene ſaid, that Denſity hath in it a power of diuiding; and that Rarity is the cauſe of being diuided; likewiſe we haue ſaid that fire, by reaſon of its ſmall partes, into which it may be cutt (which maketh them sharpe) hath alſo an eminence in diuiding: ſo that we haue two qualites, denſity and tenuity or sharpneſſe which concurre actiuely to diuiſion. We haue told you alſo how Galileus hath demonſtrated that a greater quantity of the ſame figure and denſity, hath a priuiledge of deſcending faſter then a leſſer. And that priuiledge conſiſteth in this, that the proportion of the ſuperficies to the body it limiteth (which proportion the greater it is, the more it retardeth) is leſſe in a greater bulke then in a ſmaller.

Dialog. 1. of Motion.

We haue therefore three conditions concurring to make the motion more efficacious: namely, the denſity, the sharpeneſſe, and the bulke of the mooueable. And more then theſe three, we can not expect to find in a moued body: for quantity hath but three determinations: one, by denſity and rarity; of which, denſity is one of the three conditions: an other, by its partes; as by a foote, a ſpanne, &c; and in this way wee haue found that the greater excelleth the leſſer: the third and laſt, is by its figure; and in this we find that ſubtile or edged quantities do preuayle ouer blunt ones. Seeing therefore, that theſe three determinations be all that are in quantity; there can be no more conditions in the body moued (which of neceſſity is a finite quantity) but the three named.

And as for the medium which is to be diuided, there is onely rarity and denſity (the one, to helpe; the other, to hinder,) that require conſideration on its ſide. For neither figure, nor littleneſſe and greatneſſe, do make any variation in it. And as for the Agent, it is not as yet time, before we haue looked further inte the nature of motion, to determine his qualities.

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8. Now then lett vs reflect how theſe three conditions do all agree in this circumſtance, that they helpe nothing to diuiſion, vnleſſe the body in which they are, be moued and preſſed againſt the body that is to be diuided, ſo that we ſee no principle to perſuade vs, that any body can mooue it ſelfe towards any determinate part or place of the vniuerſe, of its owne intrinſecall inclination. For beſides that the learned Author of the Dialogues de Mundo (in his third Dialogue, and the ſecond knott) hath demonſtrated that a body can not mooue vnleſſe it be mooued by ſome extrinſecall Agent; we may eaſily frame vnto our ſelues a conceite, of how abſurd it is to thinke that a body by a quality in it can worke vpon it ſelfe: as if wee ſhould ſay, that rarity (which is but more quantity) could worke vpon quantity; or that figure (which is but that the body reacheth no further) could worke vpon the body: and in generall, that the manner of any thing, can worke vpon that thing whoſe manner it is. For Ariſtotle and St. Thomas, and their intelligent commentatours, declaring the notion of *Quality*; tell vs that *to be a Quality* is nothing elſe but to be the determination or modification of the thing whoſe quality it is.

No body hath any intrinſecall vertue to moue it ſelfe towardes any determinate part of the vniuerſe.

Beſides, that the naturall manner of operation is, to worke according to the capacity of the ſubiect: but when a body is in the middeſt of an vniforme medium or ſpace, the ſubiect is equally prepared on all ſides to receiue the action of that body. Wherefore (though we ſhould allow it a force to mooue) if it be a naturall Agent, and haue no vnderſtanding, it muſt worke indifferently on all ſides, and by conſequence, can not mooue on any ſide. For if you ſay that the Agent in this caſe (where the medium is vniforme) worketh rather vpon one ſide then vpon an other; it muſt be becauſe this determination is within the Agent it ſelfe, and not out of the circumſtant diſpoſitions: which is the manner of working of thoſe ſubſtances that worke for an end of their owne; that is, of vnderſtanding creatures, and not of naturall bodies.

9. Now he that would exactly determine what motion a body hath, or is apt to haue; determining by ſuppoſition the force of the Agent, muſt calculate the proportions of all theſe three conditions of the mooueable, and the quality of the medium: which is a proceeding too particular for the intention of our diſcourſe. But to ſpeake in common, it will not be amiſſe to examine in what proportion, motion doth encreaſe; ſince we haue concluded that all motion proceedeth from quiet by a continuall encreaſe. Galileus (that miracle of our age, and whoſe witt was able to diſcouer whatſoeuer he had a mind to employ it about) hath told vs that naturall motion, encreaſeth in the proportion of the odde numbers. Which to expreſſe by example, is thus: ſuppoſe that in the going of the firſt yard it hath one degree of velocity, then in the going of the ſecond yard it will haue three degrees,

The encreaſe of motion is alwayſe made in the proportion of the odde numbers.

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degrees, and in going the third it will haue fiue: and ſo onwardes, ſtill adding two to the degrees of the velocity for euery one of the ſpace. Or to expreſſe it more plainely; if in the firſt minute of time it goeth one yard of ſpace, then in the next minute it will goe three yardes, in the third it will goe fiue, in the fourth ſeauen, and ſo forth.

But we muſt enlarge this propoſition, vnto all motions, (as we haue done the former, of the encreaſe it ſelfe in velocity;) becauſe the reaſon of it is common to all motions. Which is; that all motion (as may appeare out of what we haue formerly ſaid) proceedeth from two cauſes; namely, the Agent or the force that mooueth; and the diſpoſition of the body mooued, as it is compoſed of the three qualities we lately explicated. In which is to be noted, that the Agent doth not mooue ſimply by its owne vertue, but it applyeth alſo the vertue of the body mooued, which it hath to diuide the medium when it is putt on. As when we cutt with a knife, the effect proceedeth from the knife preſſed on by the hand; or from the hand as applying and putting in action the edge and cutting power of the knife. Now this in Phyſickes and nature is cleerely parallel to what in Geometry and Arithmetike the Mathematicians call drawing one number or one ſide into an other; for as in Mathematikes, to draw one number into an other is to apply the number drawne vnto euery part of the number into which it is drawne; as if we draw three into ſeuen we make twenty one, by making euery vnity or part of the number ſeuen to be three: and the like is of lines in Geometry. So in the preſent caſe, to euery part of the handes motion we adde the whole vertue of the cutting faculty which is in the knife, and to euery part of the motion of the knife, we adde the whole preſſing vertue of the hand. Therefore the encreaſe of the effect proceeding from two cauſes ſo working, muſt alſo be parallel to the encreaſe of the quantities ariſing out of the like drawing in Mathematikes. But in thoſe, it is euident that the encreaſe is according to the order of the odde numbers, and therefore it muſt in our caſe be the like: that is, the encreaſe muſt be in the ſaid proportion of odde numbers. Now that in thoſe, the encreaſe proceedeth ſo, will be euident, if you conſider the encreaſe of an Equicrure triangle; which (becauſe it goeth vpon a certaine proportion of length and breadth, if you compare the encreaſes of the whole triangle (that gaineth on each ſide) with the encreaſes of the perpendicular (which gaineth onely in length) you will ſee that they ſtill proceede in the foreſaid proportion of odde numbers.

Which will be better vnderſtood, if we ſett downe the demonſtration of it: lett the Equicrure triangle be A B C: and from the point A, draw the line A D perpendicular to the line B C, and lett it be diuided into three equall partes by the lines E F and

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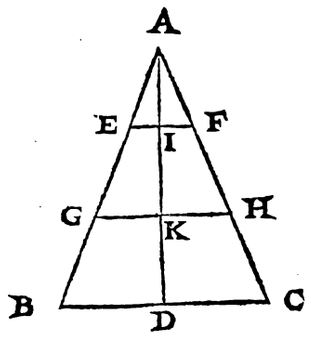
GH, in the pointes I, and K. And I say that because the line AK is tuice as long as the line AI, therefore the trapezium EFHG, is thrice as bigge as the triangle AEF: for as AK, is to AI, so is GH to EF. But the triangle AGH is to the triangle AEF, in a double proportion of the line GH to the line EF: which being double the proportion of one triangle to the other must be fourefold: so that substracting the triangle AEF, the trapezium EFHG remaineth thrice as bigge as it. And thus, the whole triangle getteth an encrease of three, whiles the perpendicular is encreased but one, to make his length two Which when it cometh to three, the trapezium GHCB that containeth the third diuision of the perpendicular, becometh fiue times as bigg as the triangle AEF; for since the line AD is three times as long as the line AI; and the line BC, is three times as long as EF; it followeth, that the triangle ABC is nine times as bigg as the triangle AEF; but AGH is foure times as bigge as AEF; therefore substracting it from the whole triangle ABC, it leaueth the trapezium GHCB fiuetimes as bigg as the first triangle AEF. Which proposition is very ingeniously sett downe by the learned Monsieur Gassendi in his first Epistle *de motu impresso a motore translato*, to the same purpose for which we bring it. Though we do not here make vse of his scheme and way of demonstration; because we had fallen vpon this before his booke came abroad: and therefore we onely note his to direct the Reader vnto it who peraduenture may like his better then ours. Howbeit we do not conceiue that he hath in his discourse there, arriued to the true reason of the effect we search into: as may appeare by what we haue already deliuered.



10. No motion can encrease for euer without coming to a periode.

But we must not imagine, that the velocity of motion will alwayse encrease thus for as long as we can fancy any motion: but when it is arriued vnto the vtmost periode that such a mooueable with such causes is capable of; then it keepeth constantly the same pace, and goeth equally and vniformely att the same rate. For since the density of the mooueable, and the force of the Agent mouing it, (which two, do cause the motion) haue a limited proportion to the resistance of the medium, how yielding soeuer it be; it must needes follow, that when the motion is arriued vnto that height which ariseth out of this proportion, it can not exceede it, but must continue at that rate, vnlesse some other cause giue yet a greater impulse to the moueable. For velocity consisting in this, that the moueable cutteth through more of the medium in an equall time; it is euident, that in the encrease of velocity, the resistance of the medium, which is ouercome by it; groweth greater and greater, and by litle and litle gaineth vpon the foree of the Agent; so that the superproportion of the Agent, groweth still lesser and lesser, as the velocity encreaseth:

and

and therefore, att the length they must come to be ballanced. And then, the velocity can encrease no more.

And the reason of the encrease of it, for a while att the beginning, is because that coming from rest it must passe, through all the intermediate degrees of velocity before it can attaine to the height of it, which requireth time to performe, and therefore falleth vnder the power of our sense to obserue. But because we see it do so for some time, we must not therefore conclude that the nature of such motion, is still to encrease without any periode or limit; like those lines that perpetually grow neerer, and yet can neuer meete: for we see that our reason examining the causes of this velocity, assureth vs that in continuance of time and space, it may come to its height, which it can not exceede.

And there, would be the pitch att which distance weights being lett fall, would giue the greatest stroakes and make greatest impressions. It is true that Galileus and Mersenius (two exact experimenters) do thinke they find this verity by their experiences. But surely that is impossible to be done; for the encrease of velocity being in a proportion euer diminishing; it must of necessity come to an insensible encrease in proportion before it endeth: for the space which the moueable goeth through, is still encreased; and the time wherein it passeth through that space, remaineth still the same litle one as was taken vp in passing a lesse space immediately before; and such litle differences of great spaces passed ouer in a litle time, come soone to be vndiscernable by sense. But reason (which sheweth vs, that if velocity neuer ceased from encreasing, it would in time arriue to exceede any particular velocity; and by consequence, the proportion which the mouer hath to the medium; becaus of the adding still a determinate part to its velocity) concludeth plainely that it is impossible, motion should encrease for euer, without coming to a periode.

Now the impression which falling weights do make, is of two kindes; for the body into which impression is made, either can yield backward, or it can not. If it can yield backward, then the impression made is a motion: as we see a stroak with a rackett vpon a ball, or with a paile maile beetle vpon a boule, maketh it fly from it. But if the strucken body can not yield backwardes, then it maketh it yield on the sides. And this, in diuerse manners: for if the smitten body be dry and brittle, it is subiect to breake it, and make the pieces fly roundabout: but if it be a tough body, it squeeseth it into a larger forme.

11. Certaine problemes resolued concerning the proportion of some moning Agents compared to their effects.

But because the effect in any of these wayse is eminently greater then the force of the Agēt seemeth to be: it is worth our labour to looke into the causes of it. To which end we may remember how we haue already declared that the force of the velocity is equall to a reciprocall force of weight in the vertue mouent: wherefore the effect of a blow that a man giueth with a hammer, dependeth vpon the weight of the hammer, vpon the velocity of the motion, and vpon the hand, in case the hand accompanieth the blow. But if the motion of the hand ceaseth

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before (as when we throw a thing) then onely the velocity and the weight of the hammer remaine to be considered. Howsoeuer, lett vs putt the hand and weight in one summe which we may equalise by some other vertue or weight. Then lett vs consider the way or space, which a weight lying vpon the thing is to goe forwardes to do the same effect in the same time as the percussion doeth. And what excesse the line of the blow, hath ouer the line of that way or space; such an excesse we must adde of equall weight or force, to the weight we had already taken. And the weight composed of both, will be a fitt Agent to make the like impression. This Probleme was proposed vnto me by that worthy religious man, Father Mersenius: who is not content with aduancing learning by his owne industry and labours; but besides, is alwayse (out of his generous affection to verity) inciting others to contribute to the publike stocke of it.

He proposed to me likewise this following question, to witt why there is required a weight of water in double Geometricall proportion, to make a pipe runne twice as fast as it did, or to haue twice as much water runne out in the same time? Vnto which I answere out of the same ground as before. That because in running twice as fast, there goeth out double water in euery part of time; and againe, euery part of water goeth a double space in the same part of time; that is to say because double the celerity is drawne into double the water, and double the water into double the celerity; therefore, the present effect is to the former effect, as the effect or quadrate of a double line drawne into it selfe, is, to the effect or quadrate of halfe the said line drawne into it selfe. And consequently the cause, of the latter effect (which is the weight then) must be to the cause of the former effect (that is, to the former weight) in the same proportion; namely as the quadrate of a double line, is to the quadrate of halfe that line. And so you see the reason of what he by experience findeth to be true. Though I doubt not but when he shall sett out the treatise, which he hath made of this subiect; the reader will haue better satisfaction.

In the meane while, an experience which Galileo deliuereth, will confirme this doctrine. He sayth that to make the same pendant goe twice as fast as it did, or to make euery vndulation of it in halfe the time it did; you must make the line att which it hangeth, double in Geometricall proportion, to the line att which it hanged before. Whence it followeth that the circle by which it goeth, is likewise in double Geometricall proportion. And this being certaine, that celerity to celerity hath the proportion of force, which weight hath to weight; it is euident, that as in one case there must be weight in Geometricall proportion; so in the other case, where onely celerity maketh the variance, the celerity must be in double Geometricall proportion, according as Galileo findeth it by experience.

But to returne to our maine intent, there is to be further noted, that

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that if the ſubiect ſtrucken be of a proportionate ceſſibility; it ſeemeth to dull and deaden the ſtroake: whereas, if the thing ſtrucken be hard the ſtroake ſeemeth to looſe no force, but to worke a greater effect. Though indeed the truth be, that in both caſes the effects are equall; but diuerſe according to the natures of the thinges that are ſtrucken; for no force that once is in nature, can be loſt; but muſt haue its adequate effect, one way or other.

Lett vs then firſt ſuppoſe the body ſtrucken to be a hard body of no exceeding biggneſſe: in which caſe, if the ſtroake light perpendiculary vpon it, it will carry ſuch a body before it. But if the body be too great, and haue its partes ſo conioyned, as that they are weaker thē the ſtroake; in this caſe, the ſtroake driueth one part before it, and ſo breaketh it from the reſt. But laſtly, if the partes of the ſtrucken body be ſo eaſily ceſſible as without difficulty the ſtroake can diuide them, then it entereth into ſuch a body vntill it hath ſpent its force. So that now making vp our account; we ſee that an equall effect proceedeth from an equall force, in all the three caſes; though in themſelues, they be farre different. But we are apt to account that effect greater, which is more conſiderable vnto vs, by the profitt or damage it bringeth vs. And therefore, we vſually ſay, that the blow which shaketh a wall, or beateth it downe, and killeth men with the ſtones it ſcattereth abroad; hath a greater effect then that which penetrateth farre into a mudde wall, and doth litle harme: for that innocuouſneſſe of the effect, maketh that although in it ſelfe it be as great as the other, yet it is litle obſerued or conſidered.

This diſcourſe draweth on an other: which is to declare how motion ceaſeth. And to ſumme that vp in short, we ſay that when motion cometh vnto reſt, it decreaſeth and paſſeth through all the degrees of celerity and tardity that are betweene reſt, and the height of that motion, which ſo declineth. And that, in the proportion of the odde numbers; as we declared aboue that it did encreaſe. The reaſon is cleare: becauſe that which maketh a motion ceaſe, is the reſiſtance it findeth: which reſiſtance, is an action of a moouer that mooueth ſome thing againſt the body which is mooued, or ſome thing equiualent to ſuch an action: wherefore it muſt follow the lawes that are common to all motions: of which kind thoſe two are that we haue expreſſed in this concluſion. Now, that reſiſtance is a countermotion, or equiualent to one; is plaine by this; that any body which is preſſed, muſt needes preſſe againe vpon the body that preſſeth it; wherefore the cauſe that hindereth ſuch a body from yielding, is a force mouing that body, againſt the body which preſſeth it. The particulars of all which we ſhall more att large declare, where we ſpeake of the action and reaction of particular bodies.

12. When a moueable cometh to reſt, the motion doth decreaſe according to the rules of encreaſe.

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THE TENTH CHAPTER.

Of Grauity and Leuity; and of Locall Motion, commonly termed Naturall.

1. Thoſe motions are called naturall which haue conſtant cauſes; and thoſe violent which are contrary to them.

IT is now time to conſider that diſtinction of motions which is ſo famous in Ariſtotle; to witt, that ſome motions are naturall, others violent: and to determine what may be ſignifyed by theſe termes. For ſeeing we haue ſaid that no body hath a naturall intrinſecall inclinarion vnto any place, to which it is able to moue it ſelfe; we muſt needes conclude that the motion of euery body followeth the percuſſion, of extrinſecall Agents. It ſeemeth therefore impoſſible that any body ſhould haue any motion naturall to it ſelfe. And if there be none naturall, there can be none violent. And ſo this diſtinction will vainsh to nothing. But on the other ſide, liuing creatures do manifeſty shew naturall motions, hauing naturall inſtruments to performe certaine motions: wherefore ſuch motions muſt of neceſſity be naturall to them. But theſe are not the motions, which we are to ſpeake of; for Ariſtotles diuiſion is common to all bodies; or att the leaſt, to all thoſe we conuerſe withall: and particulary, to thoſe which are called heauy and light: which two termes, paſſe through all the bodies we haue notice of.

Therefore, proceeding vpon our groundes before layed; to witt, that no body can be mooued of it ſelfe; wee may determine thoſe motions to be naturall vnto bodies which haue conſtant cauſes, or percutients to make them alwayſe in ſuch bodies: and thoſe violent, which are contrary to ſuch naturall motions. Which being ſuppoſed, we muſt ſearch out the cauſes that ſo conſtantly make ſome bodies deſcend towardes the center or middle of the earth; and others to riſe and goe from the center: by which, the world is ſubiect to thoſe reſtleſſe motions that keepe all thinges in perpetuall fluxe, in this changeing ſphere of action and paſſion.

2. The firſt and moſt generall operation of the ſunne, is the making and raiſing of atomes.

Lett vs then begin with conſidering what effects the ſunne (which is a conſtant and perpetuall cauſe) worketh vpon inferior bodies, by his being regularly ſometimes preſent and ſometimes abſent. Obſerue, in a pott of water hanging ouer a fire, how the heate maketh ſome partes of the water to aſcend, and others to ſupply the roome by deſcending; ſo that as long as it boyleth, it is in a perpetuall confuſed motion vp and downe. Now hauing formely cōcluded that *fire is light, and light is fire*; it can not be doubted but that the ſunne doth ſerue inſtead of fire to our globe of earth and water, (which may be fittly compared to the boyling pott;) and all the day long draweth vapors from thoſe bodies that his beames ſtrike vpon. For he shooting his little darts of fire, in multitudes, and in continued ſtreames,

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ſtreames, from his owne center, againſt the Python the earth we liue on; they do there ouertake one an-other, and cauſe ſome degree of heate as farre as they ſinke in. But not being able (by reaſon of their great expanſion in their long iorney) to conuert it into their owne nature and ſett it on fire, (which requireth a high degree of condenſation of the beames) they do but pierce and diuide it very ſubtilely, and cutt ſome of the outward partes of it into extreme litle atomes. Vnto which they ſticking very cloſe, and being in a manner incorporated with them (by reaſon of the moiſture that is in the) they do in their rebound backe from the earth carry them along with them; like a ball that ſtruck againſt a moiſt wall, doth in its returne from it, bring backe ſome of the mortar ſticking vpon it. For the diſtance of the earth from the ſunne, is not the vtmoſt periode of theſe nimble bodies flight; ſo that, when by this ſolide body they are ſtopped in their courſe forwardes on, they leape backe from it, and carry ſome litle partes of it with them: ſome of them, a farther; ſome of them, a shorter iorney; according as their litleneſſe and rarity, make them fitt to aſcend. As is manifeſt by the conſent of all authors that write of the regions of the ayre; who determine the lower region to reach as farre as the reflexion of the ſunne; and conclude this region to be very hoat.

For if we marke how the heate of fire is greateſt, when it is incorporated in ſome denſe body, (as in iron or in ſeacoale) we shall eaſily conceiue that the heate of this region proceedeth mainely out of the incorporation of light with thoſe litle bodies which ſticke to it in its reflexion. And experience teſtifyeth the ſame, both in our ſultry dayes, which we ſee are of a groſſe temper, and ordinarily goe before raine: as alſo in the hoat ſpringes of extreme cold countries, where the firſt heates are vnſufferable; which proceede out of the reſolution of humidity congealed: and in hoat windes, (which the Spaniards call *Bochornos* from Boca de horno by alluſion to the breathing ſteame of an ouen when it is opened) which do manifeſtly shew that the heate of the ſunne is incorporated in the litle bodies, which compoſe the ſteame of that wind. And by the principles we haue already layed, the ſame would be euident; though we had no experience to inſtruct vs; for ſeeing that the body of fire is dry, the wett partes (which are eaſilyeſt reſolued by fire) muſt needes ſticke vnto them, and accompany them in their returne from the earth.

3. The light rebounding from the earth with atomes, cauſeth two ſtreames in the ayre; the one aſcending the other deſcēding; and both of them in a perpendicular line.

Now whiles theſe aſcend, the ayre muſt needes cauſe others that are of a groſſer complexion to deſcend as faſt, to make roome for the former and to fill the places they left, that there may be no vacuity in nature. And to find what partes they are and from whence they come, that ſucceede in the roome of light and atomes glewed together that thus aſcend; we may take a hinte from the maxime of the Optikes, that light reflecting maketh equall angles; whence,

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ſuppoſing the ſuperficies of the earth to be circular, it will follow that a perpendicular to the center paſſeth iuſt in the middle betweene the two rayes; the incident and the reflected. Wherefore the ayre betweene theſe two rayes, and ſuch dodies as are in it being equally preſſed on both ſides; thoſe bodies which are iuſt in the middle, are neereſt and likelyeſt to ſucceede immediately in the roome of the light and atomes which aſcend from the ſuperficies of the earth: and their motion to that point, is vpon the perpendicular. Hence it is euident, that the ayre and all ſuch bodies as deſcend to ſupply the place of light and atomes, which aſcend from the earth, do deſcend perpendicularly towardes the center of the earth.

And againe ſuch bodies as by the force of light being cutt from the earth or water, do not aſcend in forme of light, but do incorporate a hidden light and heate within them; (and thereby are rarer then theſe deſcending bodies) muſt of neceſſity be lifted vp by the deſcent of thoſe denſer bodies that goe downewardes, becauſe they (by reaſon of their denſity) are mooued with a greater force. And this lifting vp, muſt be in a perpendicular line; becauſe the others deſcending on all ſides perpendicularly, muſt needes raiſe thoſe that are betweene them equally from all ſides: that is, perpendicularly from the center of the earth. And thus we ſee a motion ſett on foote, of ſome bodies continually deſcending, and others continually aſcending: all in perpendicular lines, excepting thoſe which follow the courſe of lights reflexion.

Againe as ſoone as the declining ſunne groweth weaker or leaueth our horizon, and that his beames vanishing do leaue the litle horſemen which rode vpon them, to their owne temper and nature (from whence they forced them;) they finding themſelues ſurrounded by a ſmart deſcending ſtreame, do tumble downe againe in the night, as faſt as in the day they were carryed vp; and crowding into their former habitations, they exclude thoſe that they find had vſurped them in their abſence. And thus, all bodies within reach of the ſunnes power, but eſpecially our ayre, are in perpetuall motion; the more rarifyed ones aſcending, and the denſe ones deſcending.

4. A denſe body placed in the ayre betweene the aſcending and deſcending ſtreame, muſt needes deſcend.

Now thē; becauſe no bodies whereſoeuer they be (as we haue already shewed) haue any inclination to moue towardes a particular place, otherwiſe thē as they are directed and impelled by extrinſecall Agēts: lett vs ſuppoſe that a body were placed att liberty in the opē ayre. And then caſting whether it would be mooued from the place we ſuppoſe it in; and which way it would be mooued; we ſhall find that it muſt of neceſſity, happen that it ſhall deſcend and fall downe till it meete with ſome other groſſe body to ſtay and ſupport it. For although of it ſelfe it would mooue no way: yet if we find that any other body ſtriketh efficaciouſly enough vpon it; we can not doubt but that it will mooue that way which the ſtriking body impelleth it. Now, it is

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ſtrucken vpon on both ſides (aboue and below) by the aſcending, and the deſcending atomes, the rare ones, ſtriking vpon the bottome of it, and driuing it vpwardes, and the denſer ones, preſſing vpon the toppe of it and bearing it downewardes. But if you compare the impreſſions that the denſer atomes make, with thoſe that proceede from the rare ones; it is euident that the denſe ones muſt be the more powerfull; and therefore will aſſuredly determine the motion of the body in the ayre, that way they goe; which is downewardes.

Nor neede we feare, leaſt the litleneſſe of the agents, or the feebleneſſe of their ſtroakes, should not be ſufficient to worke this effect; ſince there is no reſiſtance in the body it ſelfe, and the ayre is continually cutt in pieces, by the ſunne beames, and by the motions of litle bodies; ſo that the adheſion vnto ayre of the body to be mooued, will be no hinderance to this motion: eſpecially, conſidering the perpetuall new percuſſions, and the multitude of them; and how no force is ſo litle, but that with time and multiplication it will ouercome any reſiſtance.

5. A more partticular explicatiō of all the former doctrine touching grauity.

But if any man deſireth to looke vpon, as it were att one view; the whole chaine of this doctrine of grauity: lett him turne the firſt caſt of his eyes vpon what we haue ſaid of fire when we explicated the nature of it. To witt; that it beginneth from a litle ſource; and by extreme multiplication and rarefaction, it extendeth it ſelfe into a great ſphere. And then he will perceiue the reaſon why light is darted from the body of the ſunne with that incredible celerity, wherewith its beames flye to viſite the remoteſt partes of the world; and how, of neceſſity, it giueth motion to all circumſtant bodies; ſince it is violently thruſt forward by ſo extreme a rarefaction; and the further it goeth, is ſtill the more rarifyed and dilated.

Next, lett him reflect how infinitely the quickeneſſe of lights motion, doth preuent the motion of a moiſt body, ſuch an one as ayre is: and then he will plainely ſee, that the firſt motion which light is able to giue vnto the ayre, muſt needes be a ſwelling of that moiſt element, perpendicularly round about the earth; for, the ray deſcendent, and the ray reflectent, flying with ſo great a ſpeede, that the ayre betweene them can not take a formall plye any way before the beames of light be on both ſides of it: it followeth, that according to the nature of humide thinges, it muſt firſt onely ſwell: for that is the beginning of motion in them, when heate entereth into them, and worketh vpon them. And thus he may confidently reſolue himſelfe, that the firſt motion which light cauſeth in the ayre, will be a ſwelling of it betweene the two rayes towardes the middle of them. That is; perpendicularly from the ſurface of the earth.

And out of this, he will likewiſe plainely ſee, that if there be any other litle denſe bodies floating in the ayre, they muſt likewiſe mount a litle, through this ſwelling and riſing of the ayre. But that mounting will be no more then the immediate partes of the ayre themſelues do moue.

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Becauſe this motion is not by way of impulſe or ſtroake that the ayre giueth thoſe denſer bodies; but by way of containing them in it, and carrying them with it, ſo that it giueth them no more celerity, then to make them go with it ſelfe, and as partes of it ſelfe.

Then, lett him conſider, that light or fire, by much beating vpon the earth, diuideth ſome litle partes of it from others: whereof if any do become ſo ſmall and tractable, as not to exceede the ſtrength which the rayes haue to manage them; the returning rayes, will att their going backe, carry away with them or driue before them, ſuch litle atomes as they haue made or meete with: and ſo fill the ayre with litle bodies cutt out of the earth.

After this, lett him conſider that when light carrieth vp an atome with it, the light and the atome do ſticke together, and do make one aſcending body; in ſuch ſort as when an empty dish lyeth vpon the water, the ayre in the dish maketh one deſcendent body together with the dish it ſelfe: ſo that the denſity of the whole body of ayre and dish (which in this caſe, are but as one body) is to be eſteemed according to the denſity of the two partes; one of them being allayed by the other, as if the whole were throughout of ſuch a proportion of denſity, as would ariſe out of the compoſition and kneading together the ſeuerall denſities of thoſe two partes. Now then, when theſe litle compounded bodies of light and earth, are carried vp to a determinate height; the partes of fire or light, do by litle and litle breake away from them: and thereby, the bulke of the part which is left, becometh of a different degree of denſity (quantity for quantity) from the bulke of the entire atome, when light was part of it: and conſequently it is denſer then it was.

Beſides, lett him conſider that when theſe bodies aſcend; they do goe from a narrow roome to a large one, that is, from the centerwardes to the circumference: but when they come downe againe, they goe from a larger part to a narrower. Whence it followeth, that as they deſcend, they draw cloſer and cloſer together, and by conſequence, are ſubiect to meete and to fall in, one with an other; and thereby, to encreaſe their bulke, and to become more powerfull in denſity; not onely, by the loſſe of their fire; but alſo by the encreaſe of their quantity. And ſo it is euident, that they are denſer, coming downe, then going vp.

Laſtly, lett him conſider, that thoſe atomes which went vp firſt, and are parted from their volatile companions of fire or light, muſt begin to come downe apace, when other new atomes (which ſtill haue their light incorporated with them) do aſcend to where they are, and do goe beyond them by reaſon of their greater leuity. And as the latter atomes come vp with a violence and a great celerity, ſo muſt the firſt goe downe with a ſmart impulſe: and by conſequence, being more denſe then the ayre in which they are carryed, muſt of neceſſity cutt their way through that liquide and rare medium; and goe the next way to ſupply the defect and roome of the atomes which aſcend; (that is, perpendicularly to the earth)

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earth) and giue the like motion to any body they find in their way, if it be ſuſceptible of ſuch a motion: which it is euident that all bodies are, vnleſſe they be ſtrucken by ſome contrary impulſe. For ſince that a bodies being in a *place*, is nothing elſe but the continuity of its outſide to the inſide of the body that containeth it and is its place; it can haue no other repugnance to locall motion (which is nothing elſe but a ſucceſſiue changing of place) beſides this continuity. Now the nature of denſity, being the power of diuiding; and euery leaſt power, hauing ſome force and efficacy, (as we haue shewed aboue) it followeth that the ſtroake of euery atome (eyther deſcending, or aſcending) will worke ſome thing vpon any body (though neuer ſo bigge) it chanceth to encounter with, and ſtrike vpon in its way, vnleſſe there be as ſtrong an impulſe the contrary way, to oppoſe it. But it being determined, that the deſcending atomes are denſer then thoſe that aſcend; it followeth, that the deſcending ones will preuayle. And conſequently, all denſe bodies muſt neceſſarily tend downewardes, to the center (which is, to be *Heauy*) if ſome other more denſe body do not hinder them.

Out of this diſcourſe, we may conclude that there is no ſuch thing among bodies, as poſitiue grauity or leuity: but that their courſe vpwardes or downewardes happeneth vnto them by the order of nature, which by outward cauſes giueth them an impulſe one of theſe wayes: without which, they would reſt quietly whereſoeuer they are, as being of themſelues indifferent to any motion. But becauſe our wordes expreſſe our notions, and they are framed according to what appeareth vnto vs; when we obſerue any body to deſcend conſtantly towardes our earth, we call it heauy; and if it mooue contrary wiſe, we call it light. But we muſt take heed of conſidering ſuch grauity and leuity as if they were Entities that worke ſuch effects: ſince vpon examination, it appeareth that theſe wordes are but short expreſſions of the effects themſelues: the cauſes whereof, the vulgar of mankinde (who impoſe names to thinges) do not conſider; but leaue that worke vnto Philoſophers to examine; whiles they onely obſerue, what they ſee done; and agree vpon wordes to expreſſe that. Which wordes neither will in all circumſtances alwayes agree to the ſame thing; for as corke doth deſcend in ayre and aſcend in water; ſo alſo will any other body deſcend if it lighteth among others more rare then it ſelfe, and will aſcend if it lighteth among bodies that are more denſe then it. And we terme bodies light and heauy, onely according to the courſe, which we vſually ſee them take.

6. Grauity and leuity do not ſignify an intrinſecall inclination to ſuch a motion in the bodies themſelues which are termed heauy and light.

Now proceeding further on; and conſidering how there are various degrees of denſity or grauity: it were irrationall to conceiue, that all bodies should deſcend att the ſame rate, and keepe equall pace with one an other, in their iourney downewardes. For as two knifes whereof one hath a keener edge then the other, being preſſed with equall ſtrength into like yieſding matter, the sharper will cutt

7. The more dēſe a body is, the more ſwiftly it deſcendeth.

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deeper then the other: ſo, if of two bodies one be more denſe then the other; that which is ſo, will cutt the ayre more powerfully, and will deſcend faſter then the other: for in this caſe, denſity may be compared to the knifes edge, ſince in it conſiſteth the power of diuiding; as we haue heretofore determined. And therefore, the preſſing them downewardes by the deſcending atomes, being equall in both (or peraduenture greater in the more denſe body; as anone we shall haue occaſion to touch) and there being no other cauſe to determine them that way; the effect of diuiſion muſt be the greater, where the diuider is the more powerfull. Which, the more denſe body is; and therefore cutteth more ſtrongly through the reſiſtance of the ayre; and conſequently, paſſeth more ſwiftly that way it is determined to mooue.

8. The velocity of bodies deſcending doth not encreaſe in proportion to the difference that may be betweene their ſeuerall denſities.

I do not meane, that the velocities of their deſcent shall be in the ſame proportion to one an other, as their denſities are: for beſides their denſity, thoſe other conſiderations which we haue diſcourſed of aboue when we examined the cauſes of velocity in motion, muſt likewiſe be ballaneed. And out of the compariſon of all them; not out of the conſideration of any one alone, reſulteth the differences of their velocities: (and that neither, but in as much as concerneth the conſideration of the mooueables: for to make the calculation exact, the medium muſt likewiſe be conſidered; as by and by we shall declare) for ſince the motion dependeth of all them together; although there should be difference betweene the mooueables in regard of one onely, and that the reſt were equall; yet the proportion of the difference of their motions, muſt not follow the proportion of their difference in that one regard: becauſe their difference conſidered ſingle in that regard will haue one proportion; and with the addition of the other conſiderations (though alike in both) to their difference in this, they will haue an other.

As for example, reckon the denſity of one mooueable to be double the denſity of an other mooueable; ſo that in that regard it hath two degrees of power to deſcend, whereas the other hath but one: ſuppoſe then the other cauſes of their deſcent to be alike in both, and reckon them all three: and then ioyne theſe three to the one which is cauſed by the denſity in one of the mooueables, as likewiſe to the two, which is cauſed by the denſity in the other mooueable: and you will find that thus altogether, their difference of power to deſcend is no longer in a double proportion (as it would be, if nothing but their denſity were conſidered) but is in the proportion of fiue to foure.

But after we haue conſidered all that concerneth the mooueables, we are then to caſt an eye vpon the medium they are to mooue in; and we shall find the addition of that, to decreaſe the proportion of their difference, exceedingly more; according to the ceſſibility of the medium.

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medium. Which if it be ayre; the great disproportion of its weight, to the weight of those bodies which men vse to take in making experiences of their descent in that yielding medium; will cause their difference of velocity in descending, to be hardly perceptible. Euen as the difference of a sharpe or dull knife, which is easily perceiued in cutting of flesh or bread, is not to be distinguished in diuiding of water or oyle. And likewise in weights, a pound and a scruple will beare downe a dramme in no sensible proportion of velocity more then a pound alone would do: and yet putt a pound in that scale in stead of the dramme, and then the difference of the scruple will be very notable. So then, those bodies, whose difference of descending in water is very sensible (because of the greater proportion of weight in water, to the bodies that descend in it) will yield no sensible difference of velocity when they descend in ayre, by reason of the great disproportion of weight betweene ayre and the bodies that descend in it.

The reason of this will clearely shew it selfe in abstracted proportions. Thus; suppose ayre to haue one degree of density, and water to haue 400: then lett the mooueable A haue 410 degrees of density; and the mooueable B haue 500. Now compare their motion to one an other in the seuerall mediums of ayre and water. The exuperance of the density of A to water is 10 degrees, but the exuperance of B, vnto the same water, is 100 degrees; so that B must mooue in water, swifter then A, in the proportion of 100 to tenne; that is, of 10 to one. Then lett vs compre the exuperance of the two mooueables ouer ayre. A is 409 times more dense then ayre; but B is 499 times more dense then it. By which account, the motion of B, must be in that medium swifter then the motion of A, in the proportion of 499 to 409: that is, about 50, to 41: which (to auoyde fractions) we may account as 10 to 8. But in water they exceede one an other as 10 to one: so that their difference of velocity, must be scarce perceptible in ayre in respect of what it is in water.

Out of all which discourse, I onely inferre in common that a greater velocity in motion, will follow the greater density of the mooueable; without determining here their proportions: which I leaue vnto them, who make that examination their taske: for thus much serueth my present turne: wherein I take a suruay of nature, but in grosse. And my chiefe drift in this particular is onely to open the way for the discouering how bodies that of themselues haue no propension vnto any determinate place; do neuertheless mooue constantly and perpetually one way; the dense ones descending, and the rare ones ascending: not by any intrinsecall quality that worketh vpon them; but by the oeconomy of nature, that hath sett on foote due and plaine causes to produce knowne effects.

Here we must craue patience of the great soule of Galileo (whose

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9. More or lesse grauity doth produce a swifter or a slower descending of a heauy body. Aristotles argument to disproue motion *in vacuo*, is made good.

admirable learning all posterity must reuerence) whiles we reprehend in him, that which we can not terme lesse then absurd: and yet, he not onely mainetaineth it in seuerall places, but also professeth Dial. P de motu. pag. 8. to make it more cleare then day. His position is, that more or lesse grauity contributeth nothing att all to the faster or slower descending of a naturall body: but that all the effect it giueth vnto a body, is to make it descend or not descend in such a medium. Which is against the first and most knowne principle that is in bodies: to witt, that more doth more; and lesse doth lesse; for he alloweth, that grauity causeth a body to descend; and yet will not allow, that more grauity causeth it to descend more.

I wonder that he neuer marked how in a paire of scales, a superproportion of ouerweight in one ballance, lifted vp the other faster then a lesse proportion of ouerweight would do. Or that more weight hanged to a iacke, made the spitt turne faster; or to the lines of a clocke, made it goe faster, and the like.

But his argument whereby he endeauoureth to proove his position, is yet more wonderfull: for finding in pendants vnequall in grauity, that the lighter went in the same time almost as fast as the heauyer; he gathereth from thence, that the different weights haue each of them the same celerity: and that it is the opposition of the ayre, which maketh the lighter body not reach so farre at each vndulation, as the heauyer doth. For reply wherevnto; first we must aske him; whether experience or reason taught him, that the slower going of the lighter pendant, proceeded onely from the medium, and not from want of grauity? And when he shall haue answered (as he needes must) that experience doth not shew this; then we must importune him for a good reason: but I do not find that he bringeth any att all.

Againe; if he admitteth (which he doth in expresse termes) that a lighter body can not resist the medium, so much as a heauyer body can; we must aske him, whether it be not the weight that maketh the heauyer body resist more: which when he hath acknowledged that it is; he hath therein likewise acknowledged, that whensoeuer this happeneth in the descending of a body, the more weight must make the heauyer body descend faster.

But we can not passe this matter without noting how himselfe maketh good those arguments of Aristotle, which he seemeth by no meanes to esteeme of: for since the grauity doth ouercome the resistance of the medium in some proportion; it followeth that the proportions betweene the grauity and the medium, may be multiplyed without end; so as, if he suppose that the grauity of a body do make it goe att a certaine rate in imaginary space, (which is his manner of putting the force of grauity,) then there may be giuen such a proportion of a heauy body to the medium, as it shall goe in such a medium att the same rate; and neuertheless, there will be an

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infinite difference, betwixt the reſiſtance of the medium compared to that body, and the reſiſtance of the imaginary ſpace compared to that other body which he ſuppoſeth to be mooued in it at the ſame rate: which no man will ſticke att confeſſing to be very abſurd.

Then turning the ſcales, becauſe the reſiſtance of the medium doth ſomewhat hinder grauity, and that with leſſe reſiſtance, the heauy body mooueth faſter; it muſt follow, that ſince there is no proportion, betwixt the medium and imaginary ſpace; there muſt neither be any proportion betwixt the time in which a heauy body ſhall paſſe through a certaine quantity of the medium, and the time in which it ſhall paſſe through as much imaginary ſpace: wherefore, it muſt paſſe ouer ſo much imaginary ſpace in an inſtant. Which is the argument that Ariſtotle is ſo much laughed att for preſſing. And in a word, nothing is more euident, then that, for this effect which Galileo attributeth to grauity, it is vnreaſonable to putt a diuiſible quality, ſince the effect is indiuiſible. And therefore, as euident it is that in his doctrine ſuch aquality; as intrinſecall grauity is conceiued to be, ought not to be putt: ſince euery power ſhould be fitted to the effect, or end for which it is putt.

An other argument of Galileo is as bad as this; when he endeauoureth to prooue that all bodies goe of a like velocity, becauſe it happeneth that a lighter body in ſome caſe, goeth faſter then a heauyer body in an other caſe: as for example, in two pendants, whereof the lighter is in the beginning of its motion, and the heauyer towardes the end of it; or if the lighter hangeth att a longer ſtring, and the heauyer att a shorter; we ſee that the lighter will goe faſter then the heauyer. But this concludeth no more, then if a man ſhould prooue that a lighter goeth faſter then a heauyer, becauſe a greater force can make it goe faſter; for it is manifeſt that in a violent motion, the force which mooueth a body in the end of its courſe, is weaker then that which mooueth it in the beginning: and the like is, of the two ſtringes.

But here it is not amiſſe to ſolue a Probleme he putteth, which belongeth to our preſent ſubiect. He findeth by experience, that if two bodies deſcend att the ſame time from the ſame point, and do goe to the ſame point, the one by the inferiour quarter of the cercle; the other, by the chord to that arch, or by any other lines which are chordes to partes of that arch: he findeth (I ſay) that the mooueable goeth faſter by the arch, then by any of the chordes. And the reaſon is euident, if we conſider that the neerer any motion doth come vnto a perpendicular one downewardes, the greater velocity it muſt haue: and that in the arch of ſuch a quadrant, euery particular part of it inclineth to the perpendicular of the place where it is, more then the part of the chord anſwerable vnto it doth.

10. The reaſon why att the inferiour quarter of a circle, a body doth deſcend faſter by the arch of that quarter, then by the chord of it.

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THE ELEVENTH CHAPTER.

An answere to obiections against the causes of naturall motion, auowed in the former chapter; and a refutation of the contrary opinion.

1. The first obiection answered; why a hollow body descendeth slower then a solide one.

BVt to returne to the thridde of our doctrine; there may peraduenture be obiected against it, that if the violence of a bodies descent towardes the center, did proceede onely from the density of it (which giueth it an aptitude, the better to cutt the medium) and from the multitude of litle atomes descending that strike vpon it, and presse it the way they goe; which is downewardes: then it would not import whether the inner part of that body were as solide as the outward partes; for it cutteth with onely the outward, and is smitten onely vpon the outward. And yet experience, sheweth vs the contrary: for a great bullet of lead, that is solide and lead throughout; descendeth faster then if three quarters of the diameter were hollow within; and such a one falling vpon any resisting substance, worketh a greater effect then a hollow one. And a ball of brasse that hath but a thinne outside of mettall will swimme vpon the water, when a massie one sinketh presently. Whereby it appeareth, that it is rather some other quality belonging to the very bulke of the metall in it selfe; and not these outward causes, that occasion grauity.

But this difficulty is easily ouercome, if you consider how subtile those atomes are which descending downewardes and striking vpon a body in their way, do cause its motion likewise downewardes: for you may remember how we haue shewed them to be the subtilest and the minutest diuisions that *light*, the subtilest and sharpest diuider in nature, can make. It is then easye to conceiue that these extreme subtile bodies do penetrate all others, as light doth glasse; and do runne through them, as sand doth through a small sieue, or as water through a spunge; so that they strike, not onely vpon the superficies, but aswell in euery most interiour part of the whole body; running quite through it all, by the pores of it. And then, it must needes follow that the solider it is; and the more partes it hath within (as well as without) to be strucken vpon; the faster it must goe, and the greater effect it must worke in what it falleth vpon: whereas if three quarters of the diameter of it within, should be filled with nothing but with ayre; the atomes would fly without any considerable effect through all that space, by reason of the rarity and cessibility of it.

And that these atomes are thus subtile; is manifest by seuerall effects which we see in nature. Diuers Authors that write of Egypt, do assure vs that though their houses be built of strong stone; neuertheless, a clodde of earth layed in the inmost roomes, and shutt vp from all

appearing

appearing communication with ayre, will encreaſe its weight ſo notably, as thereby they can iudge the change of weather, which will shortly enſue. Which can proceede from no other cauſe, but from a multitude of litle atomes of ſaltpeter; which floating in the ayre, do penetrate through the ſtrongeſt walls, and all the maſſie defences in their way, and do ſettle in the clodde of earth as ſoone as they meete with it; becauſe it is of a temper fitt to entertaine and to conſerue, and to embody them. Delights haue shewed vs the way, how to make the ſpirits or atomes of ſnow and ſaltpeter paſſe through a glaſſe veſſell; which Alchimiſts hold to be the moſt impenetrable of all they can find to worke with. In our owne bodies; the aches which feeble partes do feele before change of weather, and the heauyneſſe of our heades and shoulders, if we remaine in the open ayre preſently after ſunneſett; do aboundantly teſtify, that euen the groſſer of theſe atomes (which are the firſt that fall) do vehemently penetrate our bodies: ſo as, ſenſe will make vs beleeue, what reaſon peraduenture could not.

But beſides all this, there is yet a more conuincing reaſon, why the deſcending atomes should mooue the whole denſity of a body; euen though it were ſo denſe that they could not penetrate it, and gett into the bowels of it; but muſt be content to ſtrike barely vpon the outſide of it. For nature hath ſo ordered the matter, that when denſe partes ſticke cloſe together, and make the length compoſed of them to be very ſtiffe; one can not be mooued but that all the reſt (which are in that line) muſt likewiſe be thereby mooued: ſo that if all the world were compoſed of atomes, cloſe ſticking together, the leaſt motion imaginable, muſt driue on all that were in a ſtraight line, to the very end of the world. This you ſee is euident in reaſon. And experience confirmeth it, when by a litle knocke giuen att the end of a long beame, the shaking (which maketh ſound) reacheth ſenſibly to the other end. The blind man that gouerneth his ſteppes by feeling, in defect of eyes, receiueth aduertiſements of remote thinges, through a ſtaffe which he holdeth in his handes, peraduenture more particularly then his eyes could haue directed him. And the like is of a deafe man that heareth the ſound of an inſtrument, by holding one end of a ſticke in his mouth, whiles the other end reſteth vpō the inſtrumēt. And ſome are of opinió (and they, not of the ranke of vulgar Philoſophers) that if a ſtaffe were as long as to reach from the ſunne to vs, it would haue the ſame effect in a moment of time. Although for my part I am hard to beleeue that we could receiue an aduertiſement ſo farre, vnleſſe the ſtaffe were of ſuch a thickneſſe as being proportionable to the length might keepe it from facile bending: for if it should be very plyant it would do vs no ſeruice: as we experience in a thridde, which reaching from our hand to the ground, if it knocke againſt any thing, maketh no ſenſible impreſſion in our hand.

So that in fine reaſon, ſenſe and authority do all of them shew vs, that

the leſſe the atomes should penetrate into a moouing body, by reaſon of the extreme denſity of it, the more efficaciouſly they would worke, and the greater celerity they would cauſe in its motion. And hence we may giue the fulleſt ſolution to the obiection aboue, which was to this effect: that ſeeing, diuiſion is made onely by the ſuperficies or exteriour part of the denſe body; and that the vertue whereby a denſe body doth worke, is onely its reſiſtance to diuiſion; which maketh it apt to diuide: it would follow that a hollow boule of braſſe or iron should be as heauy as a ſolide one. For we may anſwere, that ſeeing the atomes muſt ſtricke through the body; and that a ceſſible body doth not receiue their ſtroakes ſo firmely as a ſtiffe one; nor can conuey them ſo farre: if vnto a ſtiffe ſuperficies there ſucceede a yielding inſide, the ſtroakes muſt of neceſſity looſe much of their force; and conſequently, can not mooue a body full of ayre, with ſo much celerity, or with ſo much efficacy, as they may a ſolide one.

2. The ſecond obiection anſwered, and the reaſons shewne, why atomes do continually ouertake the deſcending denſe body.

But then, you may peraduenture ſay, that if theſe ſtroakes of the deſcending atomes vpon a denſe body, were the cauſe of its motion downewardes, we muſt allow the atomes to mooue faſter then the denſe body; that ſo, th y may ſtill ouertake it, and driue it along, and enter into it: whereas, if they should mooue ſlower then it, none of them could come in their turne to giue it a ſtroake, but it would be paſt them, and out of their reach before they could ſtrike it. But it is euident (ſay you) out of theſe pretended cauſes of this motion, that ſuch atomes can not mooue ſo ſwiftly downewardes, as a great denſe body; ſince their litleneſſe and their rarity, are both of them hindering to their motion: and therefore, this can not be the cauſe of that effect which we call grauity.

To this I reply; that to haue the atomes giue theſe blowes to a deſcending denſe body, doth not require that their naturall and ordinary motion should be ſwifter then the deſcent of ſuch a denſe body: but the very deſcent of it, occaſioneth their ſtriking it, for as it falleth and maketh it ſelfe a way through them, they diuide themſelues before it, and ſwell on the ſides and a litle aboue it, and preſently cloſe againe behind it and ouer it as ſoone as it is paſt. Now that cloſing, to hinder vacuity of ſpace, is a ſuddaine one; and thereby attaineth great velocity; which would carry the atomes in that degree of velocity, further then the deſcending body, if they did not encounter with it in their way to retarde them: which encounter and retarding, implyeth ſuch ſtroakes, vpon the denſe body, as we ſuppoſe to cauſe this motion. And the like we ſee in water; into which letting a ſtone fall; preſently the water that was diuided by the ſtone and swelleth on the ſides higher, then it was before, cloſeth vpon the backe of the deſcending ſtone, and followeth it ſo violently, that for a while after, it leaueth a purling hole in the place where the ſtone went downe; till by the repoſe of the ſtone, the water returneth likewiſe to its quiet; and ſo, its ſuperficies becometh euen.

In the third place, an enquiry occurreth emergent out of this doctrine, of the

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of the cauſe of bodies moouing vpwardes and downewardes. Which is; whether there would be any naturall motion deepe in the earth, beyond the actiuity of the ſunnes beames ? For out of theſe principles , it followeth that there would not: and conſequently, there muſt be a vaſt orbe in which there would be no motion of grauity or of leuity : for ſuppoſe that the ſunne beames might pierce a thouſand miles deepe into the body of the earth ; yet there would ſtill remaine a maſſe, whoſe diameter would be neere 5000 miles , in which there would be no grauitation nor the contrary motion.

3. A curious queſtion left vndecided.

For my part, I ſhall make no difficulty to grant the inference , as farre as concerneth motion cauſed by our ſunne: for what inconuenience would follow out of it ? But I will not offer att determining whether there may not be encloſed within that great ſphere of earth, ſome other fire, (ſuch as the Chymiſtes talke of) an Archeus; a Demogorgon ; ſeated in the center , like the hart in animals; which may raiſe vp vapours, and boyle an ayre out of them, and diuide groſſe bodies into atomes; and accordingly giue them motions , anſwerable to ours , but in different lines from ours, according as that fire or ſunne is ſituated: ſince the farre-ſearching Author of the Dialogues de Mundo , hath left that ſpeculation vndecided, after he had touched vpon it in the 12: knott of his firſt Dialogue.

4. The fourth obiection anſwered; why the deſcent of the ſame heauy bodies, is equall in ſo great inequality of the atomes which cauſe it.

Fourthly, it may be obiected that if ſuch deſcending atomes , as we haue deſcribed , were the cauſe of a bodies grauity , and deſcending towardes the center ; the ſame body would att diuers times deſcend more and leſſe ſwiftly : for example after midnight when the atomes begin to deſcend more ſlowly; then likewiſe , the ſame body would deſcend more ſlowly in a like proportion, and not weigh ſo much as it did in the heate of the day. The ſame may be ſaid of ſummer and winter: for in winter time, the atomes ſeeme to be more groſſe ; and conſequently , to ſtrike more ſtrongly vpon the bodies they meete with in their way as they deſcend : yet on the other ſide, they ſeeme in the ſummer to be more numerous, as alſo to deſcend from a greater height ; both which circumſtances will be cauſe of a ſtronger ſtroake and more vigourous impulſe vpon the body they hitt. And the like may be obiected of diuers partes of the world, for in the torride zone it will alwayes happen as in ſummer in places of the temperate zone ; and in the polar climes, as in deepeſt winter: ſo that no where, there would be any ſtandard or certainty in the weight of bodies, if it depended vpon ſo mutable a cauſe. And it maketh to the ſame effect , that a body which lyeth vnder a thicke rocke, or any other very denſe body , that can not be penetrated by any great ſtore of atomes; ſhould not be ſo heauy as it would be in the open and free ayre , where the atomes in their complete numbers haue their full ſtroakes.

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For answere to these and such like instances; we are to note first, that it is not so much the number, or the violence of the percussion, of the striking atomes, as the density of the thing strucken which giueth the measure to the descending of a weighty body: and the chiefe thing which the stroake of the atomes giueth vnto a dense body, is a determination of the way which a dense body is to cutt vnto it selfe: therefore, multiplication or lessening of the atomes, will not make any sensible difference betwixt the weight of one dense body, where many atomes do strike, and an other body of the same density where but few do strike; so that, the stroake downewardes of the descending atomes, be greater then the stroake vpwardes of the ascending atomes; and thereby determineth it to weigh to the centerwardes, and not rise floating vpwardes, which is all the sensible effect we can perceiue.

Next, we may obserue, that the first particulars of the obiection, do not reach home to enfeeble our doctrine in this particular, although we admitt them to be in such sort as they are proposed: for they do withall implye such a perpetuall variation of causes, euer fauourable to our position, that nothing can be inferred out of them to repugne against it. As thus: when there are many atomes descending in the ayre; the same generall cause which maketh them be many, maketh them also be light, in proportion to their multitude. And so, when they are few, they are heauy; likewise, when the atomes are light, the ayre is rarifyed and thinne; and when they are heauy, the ayre is thicke: and so vpon the whole matter it is euident that we can not make such a precise and exact iudgment of the variety of circumstances, as to be able to determine, when there is absolutely more cause of weight; and when lesse. And as we find not weight enough in either side of these opposite circumstances to turne the scales in our discourse, so likewise we find the same indifference in experience it selfe: for the weights we vse, do weigh equally in mysty weather and in cleare: and yet in rigour of discourse, we can not doubt but that in truth they do not grauitate or weigh so much (though the difference be imperceptible to sense) when the ayre is thicke and foggy, as when it is pure and rarifyed: which thickenesse of the medium, when it arriueth to a very notable degree, as for example to water, maketh then a great difference of a heauy bobies grauitation in it; and accordingly, we see a great difference betweene heauy bodies descending in watet and in ayre; though betweene two kindes of ayre, none is to be obserued, their difference is so small in respect of the density of the body that descendeth in thē. And therefore, seeing that an assured and certaine difference in circumstances maketh no sensible inequality in the effect; we can not expect any from such circumstances, as we may reasonably doubt whether there be any inequality among thē or no.

Besides

Beſides that, if in any of the propoſed caſes, a heauy body should grauitate more, and be heauyer one time then an other; yet by weighing it, we could not diſcerne it; ſince that the counterpoiſe (which is to determine its weight) muſt likewiſe be in the ſame proportion heauyer then it was. And beſides weighing, no other meanes remaineth to diſcouer its greater grauitation, but to compare it to time in its deſcent: and I beleeue that in all ſuch diſtances as we can try it in, its inequalities will be no whitt leſſe difficult to be obſerued that way, then any other.

5. The reaſon, why the shelter of a thicke body doth not hinder the deſcent of that which is vnder ti.

Laſtly, to bend our diſcourſe particularly to that inſtance of the obiection; where it is conceiued that if grauity or deſcending downewardes of bodies, proceeded from atomes ſtriking vpon them as they mooue downewardes; it would follow that a ſtone or other denſe body lying vnder shelter of a thicke, hard, and impenetrable adamantine rocke, would haue no impulſe downewardes, and conſequently would not weigh there. We may note that no body whatſoeuer, compacted by phyſicall cauſes and agents, can be ſo denſe and imporous, but that ſuch atomes, as theſe we ſpeake of, muſt be in them, and in euery part of them, and euery where paſſe through and through them; as water doth through a ſeeue or through a ſpunge: and this vniuerſall maxime muſt extend as farre as the ſunne, or as any other heate communicating with the ſunne, doth reach and is found.

The reaſon whereof, is, becauſe theſe atomes are no other thing, but ſuch extreme litle bodies as are reſolued by heate; out of the maine ſtocke of thoſe maſſy bodies vpon which the ſunne and heate do worke. Now then, it being certaine, out of what we haue heretofore ſaid, that all mixt bodies haue their temper and conſiſtence, and generation from the mingling of fire with the reſt of the Elements that compoſe them; and from the concoction or digeſtion which fire maketh in thoſe bodies: it is euident, that no mixt body whatſoeuer, nor any ſenſible part of a mixt body, can be voyde of pores capable of ſuch atomes, nor can be without ſuch atomes, paſſing through thoſe pores; which atomes by mediation of the ayre (that likewiſe hath its share in ſuch pores) muſt haue communication with the reſt of the great ſea of ayre, and with the motions that paſſe in it. And conſequently; in all and in euery ſenſible part, of any ſuch extreme denſe, and pretended impenetrable body, (to the notice whereof we can arriue) this percuſſion of atomes muſt be found; and they will haue no difficulty in running through; nor, by meanes of it, in ſtriking any other body lying vnder the shelter of it; and thus both in, and from, that hard body, there muſt be ſtill an vninterrupted continuation of grauity or of deſcending towardes the center.

Vnto which we may adde, that the ſtone or denſe body can not lye

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ſo cloſe to the rocke that couereth it, but that ſome ayre muſt be betweene, (for if nothing were betweene, they would be vnited, and become one continued body;) and in that ayre (which is a creeke of the great ocean of ayre ſpread ouer the world, that is euery where beſtrewed with moouing atomes; and which is continually fed, like a running ſtreame, with new ayre that driueth on the ayre it ouertaketh) there is no doubt but there are deſcending atomes, as well as in all the reſt of its maine body: and theſe deſcending atomes meeting with the ſtone, muſt needes giue ſome ſtroake vpon it; and that ſtroake (be it neuer ſo litle) can not chooſe but worke ſome effect, in making the ſtone remooue a litle that way they goe; and that motion, whereby the ſpace is enlarged, betweene the ſtone and the sheltering rocke, muſt draw in a greater quantity of ayre and atomes to ſtrike vpon it. And thus, by litle and litle, the ſtone paſſeth through all the degrees of tardity by which a deſcending body parteth from reſt: which is by ſo much the more ſpeedily done, by how much the body is more eminent in denſity. But this difference of time, in regard of the atomes ſtroakes onely; and abſtracting from the bodies denſity; will be inſenſible to vs; ſeeing (as we haue ſaid) no more is required of them, but to giue a determination downewardes.

6. The reaſon why ſome bodies ſinke, others ſwimme.

And out of this, we clearely ſee the reaſon why the ſame atomes, ſtriking vpon one body lying vpon the water, do make it ſinke; and vpon an other, they do not. As for example, if you lay vpon the ſuperficies of ſome water, a piece of iron, and a piece of corke, of equall biggeneſſe and of the ſame figure; the iron will be beaten downe to the bottome, and the corke will floate att the toppe. The reaſon whereof is, the different proportions of the compariſon of their denſities with the denſity of water: for (as we haue ſaid) the efficacy, and force of deſcēding, is to be meaſured by that. So then, the ſtroakes of the atomes, being more efficacious vpon water then vpon corke, becauſe the denſity of water is greater then the denſity of corke conſidering the aboundance of ayre that is harboured in the large pores of it; it followeth that the atomes will make the water goe downe more forcibly then they will corke. But the denſity of iron exceeding the denſity of water; the ſame ſtroakes will make the iron deſcend faſter then the water; and conſequently the iron muſt ſinke in the water, and the corke will ſwimme vpon it.

And this ſame is the cauſe, why if a piece of corke be held by force att the bottome of the water; it will riſe vp to the toppe of the water, as ſoone as the violence is taken away that kept it downe: for the atomes ſtroakes hauing more force vpon the water then vpon the corke; they make the water ſinke and ſlide vnder it; firſt, a litle thinne plate of water; and then an other, a litle thicker; and ſo by degrees more and more, till it hath lifted the corke quite vp to the toppe.

Fifthly it may be obiected, that theſe atomes do not deſcend alwayſe perpendicularly, but ſometimes ſloapingly; and in that caſe, if their

ſtroakes

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ſtroakes be the cauſe of denſe bodies mouing, they should moue ſloaping, and not downeward. Now that theſe atomes deſcend ſometimes ſloapingly, is euident, as when (for example) they meete with a ſtreame of water, or with a ſtrong wind, or euen with any other litle motion of the ayre, ſuch as carryeth feathers vp and downe hither and thither; which muſt needes waft the atomes in ſome meaſure along with them their way; ſeeing then that ſuch a gentle motion of the ayre is able to putt a feather out of its way, notwithſtanding the percuſſions of the atomes vpon it; why shall it not likewiſe putt a piece of iron out of its way downewardes, ſince the iron hath nothing from the atomes but a determination to its way? But much more, why should not a ſtrong wind, or a current of water, do it; ſince the atomes themſelues that giue the iron its determination, muſt needes be hurryed along with them?

7. The fifth obiection anſwered concerning the deſcending of heauy bodies in ſtreames.

To this we anſwere, that we muſt conſider, how any wind or water which runneth in that ſort, is it ſelfe originally full of ſuch atomes, which continually, and euery where, preſſe into it and cutt through it, in purſuing their conſtant perpetuall courſe of deſcending; in ſuch ſort, as we haue shewed in their running, through any hard rocke, or other denſeſt body. And theſe atomes, do make the wind or the water primarily tend downewardes; though other accidentall cauſes impell them ſecondarily to a ſloaping motion. And ſtill, their primary naturall motion will be in truth ſtrongeſt; though their not hauing ſcope to obey that, but their hauing enough, to obey the violent motion, maketh this become the more obſeruable. Which appeareth euidently out of this; that if there be a hole in the bottome of the pipe that conueyeth water ſloapingly, be the pipe neuer ſo long, and conſequently the ſloaping motion neuer ſo forcible; yet the water will runne out att that hole to obey its more powerfull impulſe to the centerwardes, rather then continue the violent motion, in which it had arriued to a great degree of celerity.

Which being ſo, it is eaſy to conceiue that the atomes in the wind or water which mooue perpendicularly downewardes, will ſtill continue the irons motion downewardes, notwithſtanding the mediums ſloaping motion: ſince the preuailing force determineth, both the iron, and the medium downewardes; and the iron hath a ſuperproportion of denſity to cutt its way, according as the preualent motion determineth it.

But if the deſcending atomes, be in part carryed along downe the ſtreame by the current of wind or water; yet ſtill the current bringeth with it, new atomes into the place of thoſe that are carryed away: and theſe atomes, in euery point of place whereſoeuer they are, do of themſelues tend perpendicularly downewardes; howbeit they are forced from the complete effect of their tendance, by the violence of the current: ſo that in this caſe they are mooued by a declining motion, compounded of their owne naturall motion, and of the forced motion,

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with which the ſtreame carryeth them. Now then if a denſe body, do fall into ſuch a current where theſe different motions giue their ſeuerall impulſes, it will be carryed (in ſuch ſort as we ſay of the atomes; but in an other proportion) not in a perpendicular but in a mixt declining line, compounded of the ſeuerall impulſes, which the atomes and the current do giue it (in which alſo it is to be remembred, how the current giueth an impulſe downewardes, as well as ſloaping; and peraduenture the ſtrongeſt downewardes:) and the declination will be more or leſſe; according, as the violent impulſe preuayleth more or leſſe againſt the naturall motion.

But this is not all that is to be conſidered in eſtimating the declination of a denſe bodies motion when it is ſinking in a current of wind or water; you muſt remember that the denſe body it ſelfe, hath a particular vertue of its owne (namely its denſity) by which it receiueth and proſecuteth more fully its determination downewardes; and therefore the force of that body in cutting its way through the medium, is alſo to be conſidered in this caſe, as well as aboue, in calculating its declining from the perpendicular; and out of all theſe cauſes will reſult a middle declination, cõpounded of the motiõ of the water or wind both wayſe, and of its owne motion by the perpendicular line. And ſince of theſe three cauſes of a denſe bodies motion, its owne vertue in proſecuting by its denſity the determination it requireth, is the moſt efficacious by much after it hath once receiued a determination from without; its declination will be but litle if it be very denſe and heauy. But if it recede much from denſity, ſo as to haue, ſome neere proportion to the denſity of the medium, the declination will be great. And in a word, according as the body is heauyer or lighter, the declination will be more or leſſe, in the ſame current though not exactly according to the proportion of the diminishing of its denſity, as long as there is a ſuperproportion of its denſity to the medium: ſince that ſuch a ſuperproportion (as we haue declared heretofore) maketh the mediums operation vpon the denſe body ſcarce conſiderable.

And hence you ſee why a ſtone or piece of iron, is not carried out of its way as well as a feather; becauſe the ſtones motion downewardes, is greater and ſtronger, then the motion of a feather downewardes. And by conſequence, the force that can deturne a feather from its courſe downewardes, is not able to deturne a ſtone. And if it be replyed, that it may be ſo ordered that the ſtone ſhall haue no motion, before it be in the ſtreame of a riuer, and notwithſtanding it will ſtill mooue downewardes; we may anſwere, that conſidering the litle decliuity of the bed of ſuch a ſtreame, the ſtrongeſt motion of the partes of the ſtreame, muſt neceſſarily be downewardes; and conſequently, they will beate the ſtone downewardes. And if they do not the like to a feather or other light body; it is becauſe other partes of the ſtreame, do gett vnder the light body; and beate it vpwardes, which they haue not power enough to do to the ſtone.

Sixthly

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Sixthly, it may be obiected, that if Elements do not weigh in their owne ſpheres; then their grauity and deſcending muſt proceede from ſome other cauſe and not from this percuſſion of the atomes we attribute it to; which percuſſion we haue determined goeth through all bodies whatſoeuer, and beateth vpon euery ſenſible part of them. But that Elements weigh not in their owne ſpheres, appeareth out of the experience of a ſyphon; for though one legge of the ſyphon, be ſuncke neuer ſo much deeper into the body of the water, then the other legge reacheth below the ſuperficies of the water: neuertheleſſe, if once the outward legge become full of water, it will draw it out of the other longer legge: which it should not do, if the partes of water that are compriſed within their whole bulke, did weigh; ſeeing that the bulke of water is much greater, in the ſunke legge then in the other: and therefore theſe should rather draw backe the other water into the ciſterne, then be themſelues drawne out of it into the ayre. 8. The ſixt obiection anſwered: and that all heauy elements do weigh in their owne ſpheres.

To this we anſwere that it is euident the Elements do weigh in their owne ſpheres, att leaſt, as farre as we can reach to their ſpheres: for we ſee that a ballone ſtuffed hard with ayre is heauyer then an empty one. Againe more water would not be heauyer then leſſe if the inward partes of it did not weigh: and if a hole were digged in the bottome of the ſea, the water would not runne into it and fill it, if it did not grauitate ouer it. Laſtly, there are thoſe who vndertake to diſtinguish in a deepe water, the diuers weights which ſeuerall partes of it haue, as they grow ſtill heauyer and heauyer towardes the bottome: and they are ſo cunning in this art, that they profeſſe to make inſtruments which by their equality of their weight to a determinate part of the water, shall ſtand iuſt in that part, and neyther riſe nor fall higher or lower: but if it be putt lower, it shall aſcend to its exact equally weighing orbe of the water; and if it be putt higher, it shall deſcend vntill it cometh to reſt preciſely in that place. Whence it is euident, that partes of water do weigh within the bulke, of their maine body; and of the like we haue no reaſon to doubt, in the other two weighty Elements.

As for the oppoſition of the ſyphon, we referre that point to where we shall haue occaſion to declare the nature of that engine, of ſett purpoſe. And there we shall shew, that it could not ſucceede in its operation, vnleſſe the partes of water did grauitate in their maine bulke, into which one legge of the ſyphon is ſunke.

Laſtly, it may be obiected, that if there were ſuch a courſe of atomes as we ſay; and that their ſtroakes were the cauſe of ſo notable an effect, as the grauity of heauy bodies: we should feele it palpably in our owne bodies, which experience sheweth vs we do not. 9. The 7th obiection anſwered: and the reaſon why we do not feele the courſe of the ayre and atomes that beat cõtinually vpon vs.

To this we anſwere firſt: that their is no neceſſity we should feele this courſe of atomes, ſince by their ſubtility they penetrate all bodies; and conſequently, do not giue ſuch ſtroakes as are ſenſible. Secondly, if we conſider that duſtes, and ſtrawes, and feathers do light vpon vs without

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cauſing any ſenſe in vs; much more we may cõceiue that atomes (which are infinitely more ſubtile and light) can not cauſe in vs any feeling of them. Thirdly, we ſee that what is continuall with vs, and mingled in all thinges doth not make vs take any eſpeciall notice of it: and this is the caſe of the ſmiting of atomes. Neuertheleſſe, peraduenture we feele them in truth, as often as we feele hoat and cold weather, and in all catarres or other ſuch changes, which do as it were ſinke into our body without our perceiuing any ſenſible cauſe of them: for no queſtion but theſe atomes are the immediate cauſes of all good and bad qualities in the ayre. Laſtly, when we conſider that we can not long together hold out our arme att length, or our foote from the ground, and reflect vpon ſuch like impotencies of our reſiſting the grauity of our owne body: we can not doubt, but that in theſe caſes we feele the effect of theſe atomes, working vpon thoſe partes; although we can not by our ſenſe diſcerne immediately that theſe are the cauſes of it.

10. How in the ſame body, grauity may be greater then denſity, and denſity then grauity; though they be the ſame thing.

But now it is time to draw our Reader out of a difficulty, which may peraduenture haue perplexed him in the greateſt part of what he hath hitherto gone ouer. In our inueſtigation of the Elements, we tooke for a principle therevnto: that grauity, is ſometimes more, ſometimes leſſe, then the denſity of the body in which it is. But in our explication of rarity and denſity; and againe in our explication of grauity; we ſeeme to putt, that grauity and denſity is all one. This thorne I apprehend, may in all this diſtance, haue putt ſome to paine: but it was impoſſible for mee to remedy it; becauſe I had not yet deliuered the manner of grauitation. Here then I will do my beſt, to aſſwage their greefe, by reconciling theſe appearing repugnancies.

We are therefore to conſider, that denſity (in it ſelfe) doth ſignify a difficultie to haue the partes of its ſubiect in which it is, ſeperated one from an other; and that grauity (likewiſe in it ſelfe) doth ſignify a quality, by which a heauy body doth deſcend towardes the center; or (which is conſequent therevnto) a force to make an other body deſcend. Now this power, we haue shewed, doth belong vnto denſity, ſo farre forth as a denſe body being ſtrucken by an other, doth not yield by ſuffering its partes to be diuided; but, with its whole bulke ſtriketh the next before it, and diuideth it, if it be more diuiſible then it ſelfe is. So that you ſee, denſity hath the name of denſity, in conſideration of a paſſiue quality or rather of an impaſſibility, which it hath; and the ſame denſity is called grauity, in reſpect of an actiue quality it hath which followeth this impaſſibility. And both of them are eſtimated by the different reſpects which the ſame body or ſubiect, in which they are, haue vnto different bodies that are the termes whereunto it is compared; for the actiue quality or grauity of a denſe body, is eſteemed by its reſpect to the body it ſtriketh vpon; whereas its denſity, includeth a reſpect ſingly to the body that ſtriketh it.

Now it is no wonder that this change of compariſon, worketh a diſparity

disparity in the denominations: and that thereby, the same body, may be conceiued to be more or lesse impartible, then it is actiue or heauy. As for example, lett vs, of a dense Element, take any one least part, which must of necessity be in its owne nature and kind absolutely impartible: and yet it is euident, that the grauity of this part must be exceeding litle, by reason of the litleness of its quantity; so that thus you see an extremity of the effect of density, ioyned together in one body (by the accident of the litleness of it) with a contrary extremity of the effect of grauity, (or rather with the want of it) each of them within the limits of the same species. In like manner it happeneth, that the same body in one circumstance is more weighty; in an other (or rather in the contrary) is more partible: so water when it is in a payle, because it is thereby hindered frō spreading abroad, hath the effect of grauity predominating in it; but if it be poured out, it hath the effect of partibility more. And thus it happeneth that meerely by the gradation of rarity and density, one dense body may be apt, out of the generall course of naturall causes, to be more diuisible, thē to be a diuider: though, according to the nature of the degrees considered absolutely in thēselues, what is more powerfull to diuide, is also more resistēt and harder to be diuided. And this arriueth in that degree which maketh water; for the falling and beating of the atomes vpon water, hath the power, both to diuide it and to make it descend: but so, that by making it descend it diuideth it. And therefore we say that it hath more grautty then density, though it be the very density of it, which is the cause that maketh it partible, by the working of one part vpon an other: for if the atomes did not find the body, so dense as it is, they could not by their beating vpon one part make an other be diuided.

So that, a dense body to be more heauy then dense, signifyeth nothing else, but that it is in such a degree of density, that some of its owne partes, by their being assisted and sett on worke by a generall cause, (which is the fall of the atomes) are powerfull enough to diuide, other adioyning partes of the same density with them, one from an other: in such sort as we see, that water poured out of an eawer into a basen where there is already other water, hath the power to diuide the water in the basen by the assistance of the celerity which it getteth in descending. And now I hope the reader is fully satisfyed that there is no contradiction in putting *Density* and *Grauity* to be the same thing materially; and that neuertheless the same thing, may be more heauy then dense, or more dense then heauy, as we tooke it to our seuerall purposes in the inuestigation of the Elements.

II. The opinion of grauities being an intrinsecall inclination of a body to the center, refuted by reason.

Hauing, thus layed an intelligible ground to discouer how these motions that are generall to all bodies, and are naturall in chiefe, are contriued by nature: we will now endeauour to shew that the contrary position is not onely voluntary, but also impossible. Lett vs therefore suppose that a body hath a quality to mooue it downewardes. And first

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wee shall aske what downewardes signifyeth: for eyther it signifyeth towardes a fixed point of imaginary space; or towardes a fixed point of the vniuerse; or towardes some mooueable point. As for the first, who would maintaine it must haue more imagination then iudgment, to thinke that a naturall quality could haue an essence determined by a nothing: becawse we can frame a conceit of that nothing. As for the second, it is very vncertaine, whether any such point be in nature: for, as for the center of the earth it is cleare that if the earth, be carryed about, the center of it can not be a fixed point. Againe, if the center signifyeth a determinate point in the earth that is the medium of grauity or of quantity, it is changed as often as any dust lighteth vnequally vpon any one side of the earth, which would make that side bigger then it was: and I doubt a quality can not haue morall considerations to thinke that so litle doth no harme. As for the third position, likewise it is not intelligible how a quality should change its inclination or essence, according to the change that should light to make now one point, now an other, be the center vnto which it should tend.

Againe, lett vs consider that a quality hath a determinate essence. Then seeing its power is to mooue, and to moue, signifyeth to cutt the mediũ it is mooued in; it belongeth vnto it of its nature, to cutt so much of such a medium in such a time. So that, if no other cause be added but that you take precisely and *in abstracto*, that quality, that medium, and that time; this effect will follow, that so much motion is made. And if this effect should not follow, it is cleare, that the being able to cutt so much of such a medium in such a time, is not the essence of this quality, as it was supposed to be. Diuiding then the time, and the medium, halfe the motion should de made in halfe the time, a quarter of the motion in a quarter of the time, and so without end, as farre as you can diuide. But this is demonstratiuely impossible; fithhence it is demonstrated that a mooueable coming from rest, must of necessity passe through all degrees of tardity; and therefore by the demonstration cited out of Galileus, we may take a part in which this grauity can not mooue its body in a proportionate part of time, through a proportionate part of the mediũ.

12. The same opinion refuted by seuerall experiences.

But becawse in naturall Theorems, experiences are naturally required; lett vs see whether nature giueth vs any testimony of this verity. To that purpose we may consider a plummet, hanged in a small string from a beame, which being lifted vp gentlely on the one side att the extent of the string, and permitted to fall meerely by the power of grauity, it will ascend very neere as high on the contrary side, as the place it was held in from whence it fell. In this experiment we may note two thinges: the first, that if grauity be a quality, it worketh against its owne nature, in lifting vp the plumett, seing its nature is onely to carry it downe. For though it may be answered that it is not the grauity; but an other quality, called *vis impressa* which carrieth it vp: neuertheless it can not be denyed, but that grauity is either the immediate or at least the mediate cause which maketh this *vis impressa*: the effect whereof, being

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contrary to the nature of grauity; it is absurd to make grauity the cause of it: that is, the cause of an essence, whose nature is contrary to its owne. And the same argument, will proceede, though you putt not *vis impressa*, but suppose some other thing to be the cause of the plummets remounting, as long as grauity is said to be a quality: for still grauity must be the cause of an effect contrary to its owne inclination, by setting on foote the immediate cause to produce it.

The second thing we are to note in this experiment of the plummets ascent is: that if grauity be a quality, there must bee as much resistance to its going vp, as there was force to its coming downe. Therefore, there must be twice as much force to make it ascend, as there was to make it descend: that is to say, there must be twice as much force, as the naturall force of the grauity is: for there must be once as much, to equalise the resistance of the grauity; and then an other time as much, to carry it as farre through the same medium in the same time. But it is impossible that any cause should produce an effect greater then it selfe.

Againe; the grauity must needes be in a determinate degree: and the vertue that maketh the plummett remount (whatsoeuer it be) may be putt as litle as we please: and consequently, not able to ouersway the grauity alone if it be an intrinsecall quality and yet the plummet will remount: in which case you putt an effect, without a cause.

An other experience we may take from the force of sucking, for take the barrell of a long gunne perfectly bored, and sett it vpright, with the breech vpon the ground, and take a bullett that is exactly fitt for it, but so as it sticke not any where (both the barrell, and it, being perfectly polished;) and then if you sucke att the mouth of the barrell (though neuer so gently) the bullett will come vp so forcibly, that it will hazard the striking out of your teeth. Now lett vs consider, what force were necessary to sucke the bullett vp, and how very slowly it would ascend, if in the barrell it had as much resistance to ascend as in the free ayre it hath inclination to goe downe. But if it had a quality of grauity naturall to it, it must of necessity haue such resistance: whereas in our experiment we see it cometh as easily as the very ayre. So that in this example as well as in the other nature teacheth vs that grauity is no quality.

And all, or most of the arguments which we haue vrged against the quality of grauity in that explication, we haue considered it in: haue force likewise against it, although it be said to be an inclination of its subiect to mooue it selfe vnto vnity with the maine stocke of its owne nature, as diuers witty men do putt it: for this supposition doth but chãge the intention or end of grauity: and is but to make it an other kind of intellectuall or knowing Entity, that determineth it selfe to an other end: which is as impossible for a naturall quality to do, as to determine it selfe to the former endes. And thus much, the arguments we haue proposed, do conuince euidently, if they be applyed against this opinion.

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THE TWELTH CHAPTER.

Of Violent Motion.

1. The ſtate of the queſtion touching the cauſe of violent motion.

AND thus, we haue giuen a short ſcātling, whereby to vnderſtand in ſome meaſure, the cauſes of that motion, which we call naturall, by reaſon it hath its birth from the vniuerſall oeconomy of nature here among vs; that is from the generall working of the ſunne, whereby all naturall thinges haue their courſe: and by reaſon that the cauſe of it is att all times, and in all places, conſtantly the ſame. Next vnto which the order of diſcourſe leadeth vs to take a ſuruay of thoſe forced motions, whoſe firſt cauſes the more apparent they are the more obſcurity they leaue vs in, to determine by what meanes they are continued.

When a tennis ball is ſtrucken by a rackett, or an arrow is shott from a bow, we plainely ſee the cauſes of their motion: namely, the ſtringes; which firſt yielding, and then returning with a greater celerity, do cauſe the miſſiues to ſpeed ſo faſt towardes their appoynted homes. Experience informeth vs what qualities the miſſiues muſt be endued withall to mooue faſt and ſteadily. They muſt be ſo heauy that the ayre may not breake their courſe; and yet ſo light, that they may be within the command of the ſtroake, which giueth them motion; the ſtriker muſt be denſe, and in its beſt velocity: the angle which the miſſiue is to mount by (if we will haue it goe to its furtheſt randome) muſt be the halfe of a right one: and laſtly, the figure of the miſſiue muſt be ſuch, as may giue ſcope vnto the ayre to beare it vp, and yet not hinder its courſe by taking too much hold of it. All this we ſee; but when withall wee ſee that the moouer, deſerteth the moueable as ſoone as he hath giuen the blow; wee are att a ſtand, and know not where to ſeeke for that which afterwardes maketh it flye: for motion being a tranſient, not a permanent thing; as ſoone as the cauſe ceaſeth that begott it, in that very point it muſt be att an end; and as long as the motion continueth, there muſt be ſome permanent cauſe to make it do ſo: ſo that as ſoone as the rackett, or bowſtring, goe backe and leaue the ball or arrow; why should not they preſently fall ſtraight downe to the ground?

2. That the medium is the onely cauſe, which continueth violent motiō.

Ariſtotle and his followers, haue attributed the cauſe hereof to the ayre: but Galileo reliſheth not this conception. His arguments againſt it, are (as I remember) to this tenor: firſt; ayre by reaſon of its rarity and diuiſibility, ſeemeth not apt to conſerue motion: next; we ſee that light thinges are beſt carried by the ayre; and it hath no power ouer weighty ones: laſtly it is euident that ayre taketh moſt hold of the broadeſt ſuperficies; and therefore an arrow would flye faſter broadwayes then longwayes, if this were true. Neuertheleſſe, ſince euery effect muſt haue a proportionable cauſe from whence it immediately floweth; and that a body, muſt haue an other body to thruſt it on, as long as it mooueth; lett

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vs examine what bodies do touch a moueable whileſt it is in motion: as the onely meanes to find an iſſue out of this difficulty; for, to haue recourſe vnto a quality or impreſſed force, for deliuerance out of this ſtraight, is a ſhift that will not ſerue the turne in this way of diſcourſe we vſe. In this Philoſophy, no knott admitteth ſuch a ſolution.

If then we enquire what body it is that immediately toucheth the ball or arrow whiles it flyeth; we shall find, that none other doth ſo, but the ayre and the atomes in it, after the ſtringes haue giuen their ſtroake, and are parted from the miſſiue. And although we haue Galileos authority, and arguments to diſcourage vs from beleeuing that the ayre can worke this effect; yet ſince there is no other body beſides it left for vs to conſider in this caſe; lett vs att the leaſt examine how the ayre behaueth it ſelfe, after the ſtroake is giuen by the ſtringes. Firſt then, it is euident, that as ſoone as the rackett or bowſtring ſhrinketh backe from the miſſiue, and leaueth a ſpace betweene the miſſiue and it (as it is cleare, it doth, as ſoone as it hath ſtrucken the reſiſting body) the ayre muſt needes clappe in with as much velocity as they retire, and with ſome what more; becauſe the miſſiue goeth forward att the ſame time, and therefore, the ayre muſt haſten to ouertake it, leaſt any vacuity should be left betweene the ſtring and the arrow. It is certaine likewiſe, that the ayre on the ſides doth alſo vpon the diuiſion of it, ſlide backe and helpe to fill that ſpace which the departed arrow leaueth voyde. Now this forcible clooſing of the ayre att the nocke of the arrow muſt needes giue an impulſe or blow vpon it: if it ſeeme to be but a litle one, you may conſider how it is yet much greater, then what the ayre and the bodies ſwimming in it, do att the firſt giue vnto a ſtone falling fro high; and how att the laſt, thoſe litle atomes that driue a ſtone in its naturall motion, do with their litle blowes force it peraduenture more violenty and ſwiftly then any impelling Agent we are acquainted with, can do. So that the impulſe which they make vpon the arrow, preſſing violently vpon it, after ſuch a vehement concuſſion, and with a great velocity, muſt needes cauſe a powerfull effect in that which of it ſelfe is indifferent to any motion any way.

But vnleſſe this motion of the ayre do continue to beate ſtill vpon the arrow, it will ſoone fall to the ground, for want of a cauſe to driue it forward; and becauſe the naturall motion of the ayre, (being then the onely one) will determine it downewardes. Lett vs conſider then, how this violent rending of the ayre by the blow that the bowſtring giueth vnto the arrow; muſt needes diſorder the litle atomes that ſwimme too and fro in it, and that (being heauyer then the ayre) are continually deſcending downewardes. This diſorder, maketh ſome of the heauyer partes of them, gett aboue others that are lighter then they; which they not abiding, do preſſe vpon thoſe that are next them, and they vpon their fellowes: ſo that there is a great commorion and vndulation cauſed in the whole maſſe of ayre round

5. A further explication of the former doctrine.

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about the arrow: which must continue some time before it can be settled: and it being determined by the motion of the arrow that way that it slideth, it followeth that all this commotion and vndulation of the ayre, serueth to continue the arrow in its flight. And thus, faster then any part behind can be settled, new ones before are stirred, till the resistance of the medium do grow stronger then the impulse of the moouers.

Besides this the arrow pressing vpon the ayre before it, with a greater velocity then the ayre (which is a liquide rare body) can admitt, to moue all of a piece without breaking: it must of necessity happen that the partes of the ayre immediately before the arrow, be driuen vpon others further of, before these can be moued to giue place vnto them; so that in some places the ayre becometh condensed, and consequently, in others rarifyed. Which also the wind that we make in walking, (which will shake a paper pinned loosely, att the wall of a chamber towardes which we walke) and the cooling ayre caused by fanning when we are hoat, do euidently confirme. So that it can not be doubted, but that condensation and rarefaction of the ayre, must necessarily follow the motion of any solide body: which being admitted it is euident that a great disorder, and for some remarkable time, must necessarily be in the ayre; since it can not brooke to continue in more rarity or density then is naturall vnto it. Nor can weighty and light partes agree to rest in an equal height or lowness; which the violence of the arrowes motion forceth them vnto for the present. Therefore it can not be denyed, but that though the arrow slide away, neuertheless there still remaineth behind it (by this condensation and confusion of partes in the ayre) motion enough to giue impulse vnto the arrow, so as to make it continue its motion after the bowstring hath left it.

4. That the ayre hath strength enough to continue violent motion in a moueable. Dial. 1. of motion pag. 98.

But here will arise a difficulty: which is, how this clapping in, and vndulation of the ayre, should haue strength and efficacy enough, to cause the continuance of so smart a motion, as is an arrowes shott, from a bow. To this I neede no other argument for an answere, then to produce Galileos testimony how great a body, one single mans breath alone, can in due circumstances giue a rapide motion vnto: and withall, lett vs consider how the arrow, and the ayre about it are already in a certaine degree of velocity; that is to say, the obstacle that would hinder it, from moouing that way (namely, the resistance of the ayre) is taken away; and the causes that are to produce it (namely the determining of the ayres, and of the atomes motion that way) are hightened. And then we may safely conclude that the arrow which of it selfe is indifferent to be mooued vpwardes or downewardes, or forwardes, must needes obey that motion which is caused in it by the atomes, and the ayres pressing vpon it; either according to the impulse of the string; or (when the string beginneth to flagge) according to the beatinges that follow the generall constitution of nature; or in a mixt manner

manner according to the proportions that these two hold to one an other. Which proportions Galileus in his 4th Dialogue of motion, hath attempted to explicate very ingeniously: but hauing missed in one of his suppositions; to witt, that forced motion vpon an horizontall line, is throughout vniforme; his great labours therein, haue taken litle effect towardes the aduancing the knowledge of nature, as he pretended: for his conclusions succeede not in experience, as Mersenius assureth vs after very exact trials; nor can they in their reasons be fitted to nature.

So that, to conclude this point; I find no difficulty in allowing this motion of the ayre strength enough to force the moueable onwardes; for some time after the first mouer is seuered from it; (and long after, we see no motions of this nature do endure:) so that we neede seeke no further cause for the continuance of it: but may rest satisfyed vpon the whole matter, that since the causes and circumstances our reason suggesteth vnto vs, are after mature and particular examination proportionable to the effects we see, the doctrine we deliuer must be sound and true.

5. An answere to the first obiection; that ayre is not apt to conserue motion: And how violent motiō cometh to cease.

For the establishing whereof, we neede not (considering what we haue already said) spend much time in soluing Galileos arguments against it: seeing that, out of what we haue sett downe, the answeres to them appeare plaine enough; for first, we haue assigned causes how the ayre may continue its motion long enough to giue as much impression as is needefull vnto the arrow, to make it goe on as it doth. Which motion is not requisite to be neere so great in the ayre behind the arrow (that drieth it on) as what the arrow causeth in the ayre before it: for by reason of the density of it, it must needes make a greater impression in the ayre it cutteth, then the ayre, that causeth its motion, would do of it selfe without the mediation of the arrow As, when the force of a hand giueth motion vnto a knife to cutt a loafe of bread, the knife, by reason of the density and of the figure it hath, maketh a greater impression in the loafe, then the hand alone would do. And this is the same that we declared in the naturall motion of a heauy thing, downewardes, vnto which we assigned two causes; namely, the beating of the atomes in the ayre, falling downe in their naturall course, to determine it the way it is to goe; and the density of the body, that cutting more powerfully then those atomes can do; giueth (together with their helpe) a greater velocity vnto the moueable, then the atomes of themselues can giue.

Nor doth it import that our resolution is against the generall nature of rare and dense bodies, in regard of conseruing motion; as Galileo obiecteth for the reason why dense bodies do conserue motion longer then rare bodies, is, because in regard of their diuiding vertue, they gett in equall times a greater velocity. Wherefore seeing that velocity is equall vnto grauity; it followeth that resistance worketh not so much vpon them as vpon rare bodies; and therefore can not make them cease from

motion ſo eaſily as it doth rare bodies. This is the generall reaſon for the conſeruation of motion in denſe bodies. But becauſe in our caſe, there is a continuall cauſe which conſerueth motion in the ayre, the ayre may continue its motion longer then of it ſelfe it would do: not; in the ſame part of ayre which Galileus (as it ſeemeth) did ayme att: but in diuers partes, in which the mooueable ſucceſſiuely is.

Which being concluded, lett vs ſee how the forced motion cometh to decreaſe and to be ended. To which purpoſe we may obſerue, that the impreſſion which the arrow receiueth from the ayre that driueth it forwardes, being weaker then that which it receiued att the firſt from the ſtring, (by reaſō, that the ayre is not ſo dēſe, and therefore cā not ſtrike ſo great a blow) the arrow doth not in this ſecond meaſure of time, (wherein we cōſider the impulſe giuen by the ayre onely) cutt ſo ſtrongly the ayre before it, nor preſſe ſo violently vpon it, as in the firſt meaſure when the ſtring parting from it did beate it forwardes: for till then, the velocity encreaſeth in the arrow, as it doth in the ſtring that carryeth it along, which proceedeth from reſt att the fingers looſe from it, to its higheſt degree of velocity; which is, when it arriueth to the vtmoſt extent of its ierke, where it quitteth the arrow. And therefore, the ayre now doth not ſo ſwiftly, nor ſo much of it, rebound backe from before, and clappe it ſelfe behind the arrow, to fill the ſpace that elſe would be left voyde by the arrowes mooving forward: and conſequently, the blow it giueth in the third meaſure, to driue the arrow on, can not be ſo great as the blow was immediately after the ſtringes parting from it; which was in the ſecond meaſure of time: and therefore, the arrow muſt needes mooue ſlower in the third meaſure then it did in the ſecond; as formerly it mooued ſlower in the ſecond (which was the ayres firſt ſtroake) then it did in the firſt, when the ſtring droue it forwardes. And thus, ſucceſſiuely in euery moment of time, as the cauſes grow weaker and weaker by the encreaſe of reſiſtance in the ayre before, and by the decreaſe of force in the ſubſequent ayre; ſo, the motion muſt be ſlower and ſlower, till it come to pure ceſſation.

6. An anſwere to the ſecond obiection that the ayre hath no power ouer heauy bodies.

As for Galileus ſecond argument; that the ayre hath litle power ouer heauy thinges; and therefore he will not allow it to be the cauſe of continuing forced motions in denſe bodies: I wish he could as well haue made experience what velocity of motion a mans breath might produce in a heauy bullett lying vpon an euen, hard, and ſlippery plaine, (for a table would be too short) as he did, how admirable great a one it produced in pendants hanging in the ayre: and, I doubt not but he would haue granted it as powerfull in cauſing horizontall motions, as he found it in the vndulations of his pendantes. Which neuertheleſſe, do ſufficiently conuince how great a power ayre hath ouer heauy bodies. As likewiſe the experience of windgunnes aſſureth vs that ayre duly applyed is able to giue greater motion vnto heauy bodies then vnto light ones. For how can a ſtraw or feather be imagined poſſibly to fly with halfe the violence

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as a bullett of lead doth out of one of thoſe engines? And when a man ſucketh a bullett vpwardes in a perfectly bored barrell of a gunne, which the bullett fitteth exactly (as we haue mentioned before) with what a violence doth it follow the breath and aſcend to the mouth of the barrell? I remember to haue ſeene a man that was vncautious and ſucked ſtrongly that had his foreteeth beaten out by the blow of the bullett aſcending.

This experiment (if well looked into) may peraduenture make good a greate part of this doctrine we now deliuer. For, the ayre preſſing in behind the bullett att the touchhole, giueth it its impulſe vpwardes; vnto which the denſity of the bullett being added, you haue the cauſe of its ſwiftneſſe, and violence; (for a bullett of wood or corke, would not aſcend ſo faſt and ſo ſtrongly) and the ſucking away of the ayre before it, taketh away that reſiſtance which otherwiſe it would encounter with, by the ayre lying in the way of it: and its following the breath with ſo great eaſe, sheweth (as we touched before) that of it ſelfe it is indifferent to any motion, when nothing preſſeth vpon it to determine it a certaine way.

7. An anſwere to the third obiection, that an arrow should fly faſter broadwayes then lõgwayes.

Now to Galileos laſt argument; that an arrow should fly faſter broadwayes, then longwayes, if the ayre were cauſe of its motion: there needeth no more to be ſaide, but that the reſiſtance of the ayre before, hindereth it as much as the impulſe of the ayre behind helpeth it on; ſo that nothing is gained in that regard; but much is loſt, in reſpect of the figure; which maketh the arrow vnapt to cutt the ayre ſo well when it flyeth broadwayes, as when it is shott longwayes: and therefore the ayre being weakely cutt ſo much of it can not clappe in behind the arrow and driue it on, againſt the reſiſtance before, which is much greater.

Thus farre, with due reſpect, and with acknowledging remembrance of the many admirable myſteries of natute which that great man hath taught the world, we haue taken liberty to diſpute againſt him: becauſe this difficulty ſeemeth to haue driuen him againſt his Genius, to beleeue that in ſuch motions there muſt be allowed a quality imprinted into the mooued body to cauſe them: which our whole ſcope both in this and in all other occaſions where like qualities are vrged, is to prooue ſuperfluous and ill grounded in nature; and to be but meere termes to confound and leaue in the darke whoſoeuer is forced to fly vnto them.

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THE THERTEENTH CHAPTER.

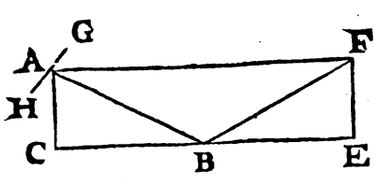
Of three ſortes of violent motion, Reflexion, Vndulation, and Refraction.

1. That reflexion is a kind of violēt motion.

THe motion we haue laſt ſpoken of, becauſe it is ordinarily either in part or wholy contrary to grauity (which is accounted the naturall motion of moſt bodies) vſeth to be called violent or forced. And thus, you haue deliuered vnto you the natures and cauſes, both of naturall and of forced motion; yet it remaineth that we aduertiſe you of ſome particular kindes of this forced motion, which ſeeme to be different from it, but indeed are not. As firſt, the motion of reflexion: which if we do but conſider how forced motion is made; we ſhall find that it is nothing elſe but a forced motion, whoſe line where-vpon it is made, is as it were ſnapped in two by the encounter of a hard body. For euen as we ſee in a ſpoute of water that is ſtrongly shott againſt a wall, the water following driueth the precedent partes firſt to the wall, and afterwardes coming themſelues to the wall, forceth them againe an other way from the wall: right ſo, the latter partes of the torrent of ayre, which is cauſed by the force that occaſioneth the forced motion, driueth the former partes, firſt vpon the reſiſtent body, and afterwardes againe from it. But this is more eminent in light then in any other body, becauſe light doth leſſe riſſent grauity; and ſo obſerueth the pure courſe of the ſtroake, better then any other body; from which, orhers do for the moſt part decline ſome way by reaſon of their weight.

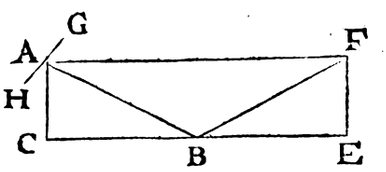
2. Reflexion is made at equall angles.

Now the particular law of reflexion is, that the line incident, and the line of reflexion muſt make equall angles, with that line of the reſiſtent ſuperficies which is in the ſame ſuperficies with themſelues. The demonſtration whereof, that great witt Renatus Des Cartes hath excellently ſett downe in his booke of Dioptrikes by the example of a ball ſtrucken by a rackett againſt the earth, or any reſiſting body: the ſubſtance where of is as followeth.



In the Rectangle Parallelogramme A E, lett C E be the ſuperficies of the earth: A, the point from which the rackett H G, ſtriketh the ball by the line A B, to the point B in the ſuperficies of the earth: and lett vs conſider C, to be on the left hand, and E on the right. Now we are to ſhew that the ball will rebound by the line B F, to the point F, in the ſame time in which it went from A to B; and ſo make the angle A B C equall to the angle F B E. For the effecting whereof, we muſt abſtract, according to the manner of mathematicians, from all Phyſicall inequalities, and ſuppoſe the ſuperficies C E, to be mathematically plaine, and the force of the rackett to continue equally ſtrong in B as it is in A: for although in truth, neyther of theſe be rigorouſly ſo; neuertheleſſe, becauſe

becauſe there is no ſenſible defect in any operation that dependeth on them, it is the ſame to our purpoſe as if they were mathematically ſo. We ſee then that the rackett H G, doth in a certaine time driue the ball from A to B; that is to ſay, from the left hand to the right, as farre as from C to B; and from aboue to downewardes, as farre as from A to C. Wee ſee againe, that the ſuperficies C E, is not contrary vnto this motion of the ball, as it goeth from the left hand to the right; for the line C E lyeth likewiſe that way: but it is contrary vnto it, as it goeth from aboue downewardes; for in that courſe the ſuperficies C E encountereth and putteth a periode to the line A C. And therefore the motion of the ball when it meeteth with the ſuperficies C E, muſt be changed from the line A C, ſo much as the ſuperficies C E is contrary vnto it; that is quite backwards as farre as it dependeth of that oppoſition. Therefore, when the ball is come to B, it muſt go from thence in the ſame proportion of left hand to right hand, and from below vpwardes, as it came before from left hand to right hand, and from aboue downewardes, when it came from A to B. And conſequently, it muſt in equall time haue paſſed an other line from left hand to right hand, as long as the line C B; and likewiſe, it muſt att the ſame time haue paſſed an other line from below vpwardes as long as A C: which will of neceſſity make it hitt in the point F, att the end of ſo much more time as it ſpent in going from A to B; and ſo, make the two angles A B C, and F B E equall; as euery one knoweth that hath but ſaluted Euclide.



3. The cauſes and properties of vndulation.

The motion which we call vndulation needeth no further explication: for it is manifeſt, that ſince a pendant, when it is remooued from its perpendicular, will reſtore it ſelfe therevnto by the naturall force of grauity, and that in ſo doing it gaineth a velocity, (and therefore can not ceaſe on a ſuddaine,) it muſt needes be carried, out of the force of that motion, directly the cõtrary way: vntill the force of grauity, ouercoming the velocity, it muſt be brought backe againe to the perpẽdicular: which being done likewiſe with velocity, it muſt ſend it againe towardes the place from which it fell att the firſt. And in this courſe of motion it muſt cõtinue for a while, euery vndulation being weaker then other, vntill att laſt it quite ceaſeth, by the courſe of nature ſettling the ayre in its due ſituatiõ according to the naturall cauſes that worke vpon it. And in this very manner alſo is performed that vndulation which we ſee in water, when it is ſtirred from the naturall ſituation of its ſphericall ſuperficies.

Galileo hath noted that the time in which the vndulations are made which follow one an other of their owne accord, is the ſame in euery one of them; and that as much time preciſely is taken vp in a pendants going a very ſhort arch towardes the end of its vibration, as was in its going of the greateſt arch att the beginning of its motion. The reaſon whereof ſeemeth ſtrange to him, and he thinketh it to be an accident naturall to

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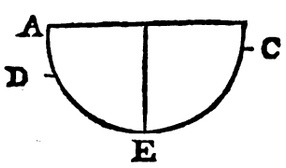
the body out of its grauity; and that this effect conuinceth, it is not the ayre which mooueth ſuch bodies. Whereas in truth, it is clearly the ayre which cauſeth this effect. Becauſe the ayre ſtriuing att each end (where it is furtheſt from the force of the motion) to quiett it ſelfe, getteth att euery bout ſomewhat vpon the ſpace; and ſo, contracteth that into a shorter arch.

But it is a great wonder to me, that Galileo should make a wonder of this effect; to the reaſon of which, he hath layed ſo faire a fundation vpon an other occaſion; had he but reflected vpon it. For in his fourth Dialogue of motion he hath demonſtrated that a naturall mooueable deſcending in the quarter of a circle, from what part ſoeuer it beginneth, ſpendeth equall time to come to the loweſt point, as if it came from any other part: ſo that a pendāt being brought vp to any height by the force of a former motion downewardes, it will be ſure to ſpend as much time in going downe from thence to the perpendicular, as it did att the firſt when it was lett fall from the greateſt height. Now I ſubſume, that the pendants aſcending, being the effect of the velocity of its motion gained in deſcending immediately before; the ſaid velocity muſt be able tó carry it in the ſame time to a height, that is proportionate to that hight vnto which the velocity, gained in the firſt fall did cauſe the pendant to mount. As for example: if the pendants firſt deſcent, were from A to E, the ſecond from C to E; becauſe the time of thoſe two, is the ſame, (as Galileus hath demonſtrated) it followeth that their velocities gained in deſcending muſt of neceſſity be in the proportion of the line A E to the line C E: therefore, their effects alſo muſt be proportionable. Lett vs then putt the line E D in that proportion to the line C E, which C E hath to A E; and then the velocity gained in C E will carry the pendant vp from E to D, in the ſame time in which the deſcent A E did carry it vp the other way from E to C: wherefore, ſeeing that the times of its deſcent from A to E, and from C to E are equall, likewiſe, the two vibrations from A to C and from C to D will be done in equall times. But that which made Galileo not ſee the force of the conſequence, was that he did not acknowledge violent motion to be made in the ſame proportions, and for the ſame reaſons which are found in naturall motion: which we haue aboue shewed to be ſo, where we diſcourſed of that matter.



4. Refraction at the entrance into the reflectent body is towardes the perpendicular; at the going out it is from it; when the ſecōd ſuperficies is parallel to the firſt.

That motion alſo which we call *Refraction*, and is manifeſt to ſenſe, onely in light; (though peraduenture hereafter more diligent ſearchers of nature, may likewiſe find it in ſuch other bodies as are called qualities; as in cold or heate, &c.) is but a kind of Reflexion: for there being certaine bodies, in which the paſſages are ſo well ordered with their reſiſtances, that all the partes of them ſeeme to permitt light to paſſe through them, and yet all partes of them ſeeme to reflect it; when light

paſſeth

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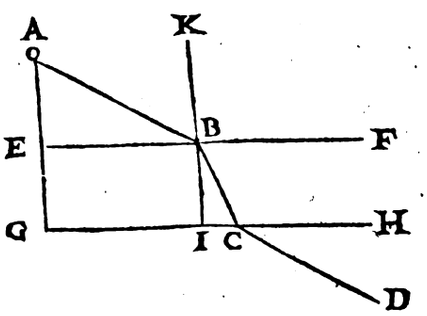
passeth through such bodies, it findeth att the very entrance of them, such resistances, where it passeth, as serue it for a reflectent body; and yet such a reflectent body, as hindereth not the passage through; but onely hindereth the passage from being in a straight line with the line incident. Wherefore the light must needes take a plye as beaten from those partes towardes a line drawne from the illuminant, and falling perpendicularly vpon the resisting superficies; and therefore is termed by mathematicians, to be refracted or broken towardes the Perpendicular. Now at the very going out againe of the light, the second superficies (if it be parallel to the former) must needes vpon a contrary cause, strike it the contrary way: which is termed from the Perpendicular.

As for example: if the ray A B, lighteth vpon the superficies E B F; and findeth entrance; it is not now the superficies E F, that resisteth or reflecteth it: but it is that part of the inside (as we may say) of the pore B, which is towardes F; and is a Physicall body; not a Mathematicall point. The reflexion therefore must be made, as if the reflectent body were I B K: but it is euident that if A B, did strike vpon I K, it would reflect towardes A G. But becausse we know not the inclination of the superficies I K, whether it be truly a perpendiculat or no, therefore we can not tell the quantity of the inclination which this reflexion must make; but onely we know that it must be towardes A G.



§.

A refutation of Monsieur Des Cartes his explication of refraction.

But before we wade any deeper into this difficulty, we can not omitt a word of the manner of explicating refraction which Monsieur Des Cartes vseth, so witty a one as I am sorry it wanteth succesſe. He therefore following the demonstration aboue giuen of reflexion; suppoſeth the superficies which a ball lighteth vpon, to be a thinne linnen cloth, or some other such matter as will breake cleanely by the force of the ball striking smartly vpon it. And becausse that superficies resisteth onely one way, therefore he inferreth that the velocity of the ball is lessened onely one way and not the other: so that the velocity of its motion that way in which it findeth no resistance, must be (after the balles passage through the linnen) in a greater proportion to the velocity which it hath the other way where it findeth resistance, then it was before. And therefore the ball will in lesse time arriue to its periode on the one side then on the other: and consequently, it will leane towardes that side, vnto which the course wherein it findeth no opposition, doth carry it.

But how much he is mistaken vpon the whole matter, a little figure will shew: lett vs therefore putt a Rectangle Parallelogramme as before A E, which I double and make the whole Parallelogramme A L,

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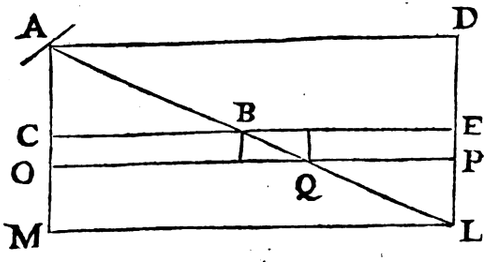
and draw out the line A B, till it cometh to L. Now we must imagine that C E, is the cloth or passable superficies which Monsieur Des Cartes putteth; and B L the line it would goe in, if there were no resistance. Next we must seeke the perpendicular, which according to our explication, is A C: for that, falleth from A the illuminant, perpendicularly vpon C E; although, some who defend Monsieur Des Cartes, seeme to make another line the perpendicular; against the conception of all those that write of Optikes. But, not to trouble our selues with termes; the question is, whether the ball that passeth, the cloth, must (after its passage through) deflect from the line B L, (which it would haue kept, had there beene no resistance) towardes E; or else deflect from that line towardes C. And both experience and reason do assure vs, that it must turne towardes C: but Monsieur Des Cartes sayth towardes E.



Which to shew how it is contrary vnto his owne principle; lett vs conceiue the cloth C E to be of some thickenesse, and so draw the line O P to determine that thickenesse. And lett vs make from B vpon A L, an other Parallelogramme like the Parallelogramme A L, whose diameter shall be B Q. And it must necessarilly follow that the motion from B to Q, if there were no resistance, were in the same proportion as from A to B. But the proportion of the motion from A to B, is the proportion of C B to C A; that is, it goeth in the same time faster towardes D, then it doth towardes M, in the proportion which C B hath to C A. By which account, the resistance it hath in the way towardes D, must also be greater then the resistance it hath in the way towardes M, in the proportion which C B hath to C A; and therefore the more tardity must be in the way to D, and not in the way to M; and consequently, the declination must be from E wardes, and to M wardes. For where there is most resistance, that way likewise must the tardity be greatest, and the declination must be from that way: but which way the thickenesse, to be passed in the same time, is most, that way the resistance is greatest: and the thickenesse is clearely greater towardes E, then towardes M; therefore, the resistance must be greatest towardes E; and consequently the declination from the line B L must be towardes M, and not towardes E.

But the truth is, that in his doctrine the ball would goe in a straight line as if there were no resistance; vnlesse peraduenture towardes the contrary side of the cloth, att which it goeth out into the free ayre: for as the resistance of the cloth is greater in the way towardes D, then in the way towardes M, (becausse it passeth a longer line in the same time, as also it did formerly in the ayre) so likewise is the force that mooueth it

that

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that way, greater then the force which mooueth it the other. And therefore the ſame proportions that were in the motion, before it came to the reſiſting paſſage, will remaine alſo in it: att the leaſt vntill coming neere the ſide att which it goeth out, the reſiſtance be weakned by the thinneneſſe of the reſiſtent there: which becauſe it muſt needes happen on the ſide, that hath leaſt thickneſſe, the ball muſt conſequently, turne the other way, where it findeth greateſt yielding: and ſo att its getting out into the free ayre, it will bend from the greater reſiſtance, in ſuch manner as we haue ſaid aboue.

6. An anſwere to the arguments brought in fauour of Monſieur Des Cartes his opinion.

Neither do the examples brought by Monſieur Des Cartes, and others in maintenance of this doctrine any thing auayle them: for when a canon bullett ſhott into a riuer, hurteth the people on the other ſide; it is not cauſed by refraction, but by reflexion, as Monſieur Des Cartes himſelfe acknowledgeth: and therefore, hath no force to prooue any thing in refraction; whoſe lawes are diuers from thoſe of pure reflexion.

And the ſame anſwere ſerueth againſt the inſtance of a muskett bullett ſhott att a marke vnder water; which perpetually lighteth higher then the marke, though it be exactly iuſt aymed att. For we knowing that it is the nature of water, by ſinking in one place to riſe round about, it muſt of neceſſity follow that the bullett which in entring hath preſſed downe the firſt partes of the water, hath withall thereby putt others further off in a motion of riſing: and therefore the bullet in its goeing on muſt meete with ſome water ſwelling vpwardes, and muſt from it receiue a ply that way; which can not faile of carrying it aboue the marke it was leuelled att. And ſo we ſee this effect proceedeth, from reflection or the bounding of the water, and not from refraction. Beſides that it may iuſtly be ſuſpected, the ſhooter tooke his ayme too high, by reaſon of the markes appearing in the water higher then in truth it is: vnleſſe ſuch falſe ayming were duly preuented.

Neither is Monſieur Des Cartes his excuſe to be admitted, when he ſayth that light goeth otherwiſe, then a ball would do, becauſe that in a glaſſe or in water, the etheriall ſubſtance, which he ſuppoſeth to runne through all bodies is more efficaciouſly mooued then in ayre: and that therefore, light muſt go faſter in the glaſſe then in the ayre, and ſo turne on that ſide of the ſtraight line which is contrary to the ſide that the ball taketh, becauſe the ball goeth not ſo ſwiftly. For, (not to diſpute of the verity of this propoſition) the effect he pretendeth, is impoſſible: for if the etheriall ſubſtance in the ayre before the glaſſe, be ſlowly mooued (the motion of which, he calleth light) it is impoſſible that the etheriall ſubſtance in the glaſſe or in the water ſhould be more ſmartly mooued then it. Well it may be leſſe; but without all doubt, the impulſe of the etheriall ſubſtance in the glaſſe can not be greater then its adequate cauſe which is the motion of the other partes that are in the ayre precedent to the glaſſe.

Againe; after it is paſſed the glaſſe, it ſhould returne to be a ſtraight

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line with the line that it made in the ayre precedent to the glaſſe : ſeeing that the ſubſequent ayre muſt take off iuſt as much; (and no more) as the glaſſe did adde : the contrary whereof experience sheweth vs.

Thirdly, in this explication, it would alwayes go one way in the ayre, and an other way in the glaſſe: whereas all experience teſtifyeth; that in a glaſſe conuexe on both ſides, it ſtill goeth in the ayre after its going out, to the ſame ſide as it did in the glaſſe ; but more. And the like happeneth in glaſſes on both ſides concaue. Wherefore it is euident, that it is the ſuperficies of the glaſſe, that is the worker on both ſides; and not the ſubſtance of the ayre on the one ſide, and of the glaſſe on the other.

And laſtly; his anſwere doth no wayes ſolue our obiection, which prooueth that the reſiſtance both wayes is proportionate to the force that mooueth, and by conſequence that the thing moued muſt go ſtraight. As we may imagine would happen, if a bullett were shott ſloaping through a greene mudde wall, in which there were many round ſtickes, ſo thinne ſett that the bullett mighr paſſe with eaſe through them; for as long as the bullett touched none of them (which expreſſeth his caſe) it would go ſtraight ; but if it touched any of them (which reſembleth ours, as by and by will appeare) it would glance according to the quality of the touch, and mooue from the ſticke in an other line.

Some peraduenture may anſwere for Monſieur Des Cartes that this ſubtile body which he ſuppoſeth to runne through all thinges is ſtiffe and no wayes plyable. But that, is ſo repugnant to the nature of rarity and ſo many inſuperable inconueniencies do follow out of it; as I can not imagine he will owne it: and therefore I will not ſpend any time in replying therevnto.

7. The true cauſe of refraction of light both at its entrance, and att its going out from the reflecting body.

We muſt therefore ſeeke ſome other cauſe of the refraction of light which is made att the entrance of it into a diaphanous body. Which is plainely (as we ſaid before) becauſe the ray ſtriking againſt the inſide of a body it can not penetrate, turneth by reflexion towardes that ſide on which the illuminant ſtandeth: and if it findeth cleare paſſage through the whole reſiſtent, it followeth the courſe it firſt taketh; if not then it is loſt by many reflexions too and fro.

And that this doctrine is true, the accidents or Phoenomens euidently declare vnto vs; for experience teacheth vs that vpon a plaine ſuperficies the refraction is made towardes the perpendicular drawne from the illuminant to the ſuperficies; as we haue ſaid. Now att the going out (if the ſurfaces be parallels) we ſee that the ray turneth from that perpendicular; which alſo is neceſſary: for going through a pore bigger then it ſelfe, or att the leaſt as bigge; and finding it full of ayre; it muſt needes be crouded there. But in a croude, he preſſeth you moſt, whom you preſſe moſt vpon: ſo then that ſide of the pore which is next to the light as it paſſeth, muſt preſſe moſt vpon it: but the angle which is

towardes

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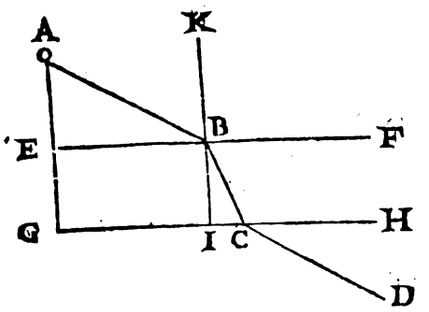
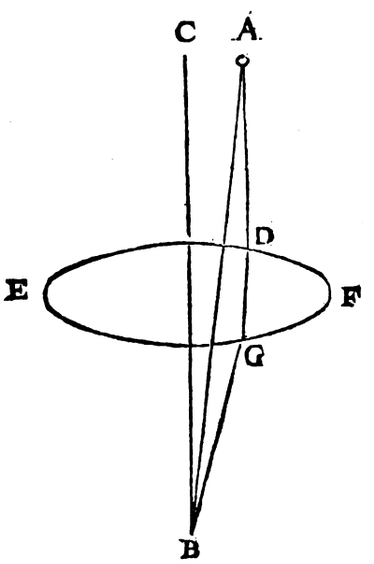
towardes the perpendicular, to witt the angle B C I, is the lesser; and by consequence, the ray is neerer that side of the pore which is towardes I, then the other side of it which is towardes H; wherefore it must take its ply from that side. But that side striketh it from the perpendicular: and therefore, it must there refract from the perpendicular.

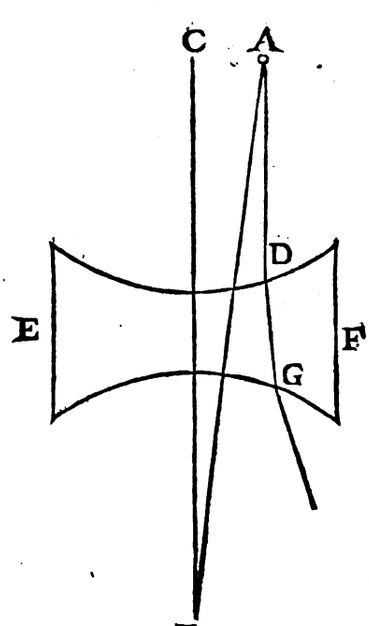


This very same doctrine for the reason of refraction is confirmed by what happeneth in crooked superficieses. As if E F, be a *Lens* or a glasse on both sides conuexe; and C B, the axis of it; A D, the ray falling from the illuminant A; A B, the perpendicular falling from the same illuminant A: it will be plaine by the former discourse, that the ray A D, must att the entry be refracted towardes A B, as being repulsed from that part of the inside of the pore D, which is towardes F; because that side is most opposed vnto the ray. Now the ray being once turned that way; when att the end of its iorney through the glasse, it is come to the other superficies E G F, it maketh the lesser angle towardes F; and therefore it must by the rule giuen aboue, be refracted againe att its parting from the glasse, towardes the same perpendicular; and it will meete some where with the axis C B; all which experience sheweth vs to be true.



And taking a body of concaue surfaces we shall (according to this doctrine of ours) find the causes of refraction iust contrary; and accordingly, experience likewise sheweth vs, the effects to be so too. And therefore since experience agreeth exactly with our rules, we can not doubt but that the principles vpon which we goe, are well layd.

But because crooked surfaces may haue many irregularities; it will not be amisse to giue a rule by which all of them may be brought vnto a certainety. And this it is, that reflexions from crooked superficieses, are equall to the reflexions



8. A generall rule to know the nature of reflexions and refractions in all sortes of surfaces.

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that are made from ſuch plaine ſuperficieſes , as are tangents to the crooked ones in that point from whence the reflexions are made. Which principall the Maſters of Optikes do take out of a Mathematicall ſuppoſition of the vnity of the reflecting point, in both the ſurfaces; the crooked and the plaine. But we take it out of the inſenſibility, of the difference of ſo litle a part in the two different ſurfaces, as ſerueth to reflect a ray of light: for where the difference is inſenſible in the cauſes; there likewiſe the difference is ſo litle in the effects as ſenſe can not iudge of them: which is as much as is requiſite to our purpoſe. Now ſeeing that in the Mathematicall ſuppoſition, the point where the reflexion is made is indifferent to both the ſurfaces; it followeth that it importeth not whether ſuperficies you take to know the quality of reflexion by. This principle then being ſettled, that the reflexion muſt follow the nature of the tangent ſurfaces; and it being prooued, that in plaine ſurfaces it will happen in ſuch ſort as we haue explicated, it followeth that in any crooked ſuperficies of what figure ſoeuer, the ſame alſo will happen.

Now ſeeing we haue formerly declared, that refractions are but a certaine kind of reflexions, what we haue ſaid here of reflexions, may be applyed to refractions.

9. A body of greater partes and greater pores, maketh a greater refraction then one of leſſer partes and leſſer pores.

But there remaineth yet vntouched, one affection more of refractions; which, is, that ſome diaphanous bodies do in their inward partes reflect more then others (which is, that which we call refraction) as experience sheweth vs. Concerning which effect, we are to conſider that diaphanous bodies, may in their compoſition haue two differences: for ſome are compoſed of greater partes and greater pores; others of leſſer partes and leſſer pores. It is true, there may be other combinations of pores and partes, yet by theſe two, the reſt may be eſteemed. As, for the firſt combination, we ſee that becauſe the pores are greater, a greater multitude of partes of light may paſſe together through one pore; and becauſe the partes are greater, likewiſe a greater multitude of rayes may reflect from the ſame part, and may find the ſame paſſage quite throughout the diaphanous body. On the contrary ſide, in the ſecond combination where both the pores and the partes of the diaphanous body are litle, the light muſt be but litle that findeth the ſame paſſage.

Now, that refraction is greater or leſſer, happeneth two wayes; for it is, eyther when one diaphanous body reflecteth light att more angles then an other, and by conſequence in a greater extent of the ſuperficies; or elſe, when one body reflecteth light from the ſame point of incidence in a shorter line and in a greater angle, then an other doth. In both theſe wayes it is apparant, that a body compoſed of greater partes and greater pores, exceedeth bodies of the oppoſite kind: for by reaſon that in the firſt kind, more light may beate againſt one part; a body in which that happeneth, will make an appearance from a further part of its ſuperficies: whereas in a body of the other ſort; the light that beateth againſt one of the

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of the litle partes of it, will be ſo litle, as it will preſently vanish. Againe, becauſe in the firſt, the part att the incidence is greater; the ſurface from which the reflexion is made inwardes, hath more of a plaine and ſtraight ſuperficies: and conſequently doth reflect att a greater angle, then that, whoſe ſuperficies hath more of inclining.

10. A cõfirmation of the former doctrine, out of the nature of bodies that refract light.

But we muſt not paſſe from this queſtion, without looking a litle into the nature of thoſe bodies in which refraction is made: for if they as well as the immediate cauſes of refraction, do likewiſe fauour vs; it will not a litle aduance the certainety of our determination. To this purpoſe we may call to mind, how experience sheweth vs that great refractions are made in ſmoake, and in miſtes, and in glaſſes, and in thicke bodied waters; and Monſieur Des Cartes, addeth certaine oyles, and ſpirits or ſtrong waters.

Now moſt of theſe we ſee are compoſed of litle conſiſtent bodies, ſwimming in an other liquide body. As is plaine in ſmoake and miſtes: for the litle bubbles which riſe in the water before they gett out of it; and that are ſmoake when they gett into the ayre; do aſſure vs that ſmoake is nothing elſe, but a company of litle round bodies, ſwimming in the ayre: and the round conſiſtence of water vpon herbes, leafes, and twigges in a rynde or dew, giueth vs alſo to vnderſtand that a miſt is likewiſe a company of litle round bodies that ſometimes ſtand, ſometimes floate in the ayre, as the wind driueth them. Our very eyes beare wittneſſe to vs, that the thicker ſort of waters are full of litle bodies, which is the cauſe of their not being cleare.

As for glaſſe, the blowing of it conuinceth, that the litle dartes of fire which pierce it euery way, do naturally in the melting of it conuert it into litle round hollow bodies, which in their cooling muſt ſettle into partes of the like figure. Then for cryſtall and other tranſparent ſtones which are found in cold places; it can not be otherwiſe, but that the nature of cold piercing into the maine body, and contracting euery litle part in it ſelfe; this contraction muſt needes leaue vacant pores betweene part and part. And that ſuch tranſparent ſtones as are made by heate, haue the like effect and property, may be iudged out of what we ſee in brickes and tiles, which are left full of holes by the operation of the fire. And I haue ſeene in bones that haue layne a long time in the ſunne, a multitude of ſenſible litle pores cloſe to one an other, as if they had beene formerly ſtucke all ouer with ſubtile sharpe needles as cloſe as they could be thruſt in by one other. The Chymicall oyles and ſpirits which Monſieur Des Cartes ſpeaketh of, are likely to be of the ſame compoſition; ſince that ſuch vſe to be extracted by violent fires: for a violent fire is made by the coniunction of many rayes together; and that muſt needes cauſe great pores in the body it worketh vpon; and the ſticking nature of theſe ſpirits, is capable of conſeruing them.

Out of all theſe obſeruations it followeth, that the bodies in which greateſt refractions do happen, are compounded (as we haue ſaid) of

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great partes, and great pores. And therefore, by onely taking light to be such a body, as we haue described it to be, where we treated of the nature of it; it is euident, that the effect which we haue expressed, must necessarily follow by way of reflexion: and that refraction is nothing else but a certaine kind of reflexion.

Which last assertion, is likewise conuinced out of this; that the same effects proceede from reflexion as from refraction: for by reflexion a thing may be seene greater then it is; in a different place from the true one where it is: colours may be made by reflexion, as also, gloating light; and fire likewise; and peraduenture all other effects which are caused by refraction, may as well as these, be performed by reflexion. And therefore it is euident, they must be of the same nature; seing that children are the resemblances of their parents.

THE FOVRETEENTH CHAPTER.

Of the composition, qualities, and generation of Mixed bodies.

1. The cõnexion of this chapter with the rest, and the Authors intent in it,

HAuing now declared the vertues by which fire and earth worke vpon one an other, and vpon the rest of the elements; which is, by light, and by the motions we haue discoursed of. Our taske shall be in this chapter first to obserue what will result out of such action of theirs: and next to search into the wayes and manner of compassing and performing it. Which latter we shall the more easily attaine vnto, when we first know the end that their operation leuelleth att. In this pursute we shall find that the effect of the Elements combinations, by meanes of the motions that happen among them; is a long pedigree of compounded qualities and bodies: wherein, the first combinations (like marriages) are the breeders of the next more composed substances: and they againe are the parents of others in greater variety: and so are multiplyed without end; for the further this worke proceedeth, the more subiects it maketh for new businesse of the like kind.

To descend in particular vnto all these, is impossible. And to looke further then the generall heades of them, were superfluous and troublesome in this discourse; wherein I ayme onely att shewing what sorts of thinges, in common, may de done by bodies: that if hereafter, we meete with thinges of an other nature and straine, we may be sure, they are not the ofspring of bodies and of quantity; which is, the maine scope of what I haue designed here. And to do this with confidence and certainety, requireth of necessity this leisurely and orderly proceeding that hitherto we haue vsed, and shall continue to the end: for, walking thus softly, we haue alwayes one foote vpon the ground; so as the other may be sure of firme footing before it settle. Whereas, they that for more hast will leape

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leape ouer rugged paſſages and broken ground; when both their feete are in the ayre, can not helpe themſelues, but muſt light as chance throweth them.

To this purpoſe then we may conſider, that the qualities of bodies in common are of three ſortes: for they are belonging, either to the conſtitution of a compounded body, or elſe, to the operation of it; and the operation of a body, is of two kindes; the one, vpon other bodies; the other, vpon ſenſe. The laſt of theſe three ſortes of qualities, ſhall be handled in a peculiar chapter by themſelues. Thoſe of the ſecond ſort, whereby they worke vpon other bodies, haue beene partly declared in the former chapters, and will be further diſcourſed of in the reſt of this firſt treatiſe: ſo as that which remaineth for the preſent, is to fall vpon the diſcourſe of ſuch qualities as concurre to the conſtitution of bodies; with an ayme to diſcouer, whether (or no) they may be effected by the ſeuerall mixtures of rarity and denſity, in ſuch ſort as is already declared. To which end, we are to conſider in what manner theſe two primary differences of bodies may be ioyned together: and what effects ſuch coniunction will produce.

2. That there is a leaſt ciſe of bodies, and that this leaſt ciſe is found in fire.

As for their coniunction: to deliuer the nature of it entirely, we muſt begin from the very roote of it, and conſider how the Vniuerſe being finite (which Mr. White hath demonſtrated in the ſecond knott of his firſt Dialogue) there can not be an infinite number of bodies in it: for Geometricians ſhew vs how the leaſt quantity that is, may be repeated ſo often as would exceede any the greateſt determinate quantity whatſoeuer. Out of which it followeth, that although all the other bodies of the world were no bigger then the leaſt quantity that can be deſigned; yet they being infinite in number, would be greater then the whole Vniuerſe that containeth them. And therefore, of neceſſity there muſt be ſome leaſt body, or rather, ſome leaſt ciſe of bodies: which in compounded bodies, is not to be expected: for, their leaſt partes being compounded, muſt needes include compounding partes leſſe then themſelues. We muſt then looke for this leaſt ciſe of bodies in the Elements; which of all bodies are the ſimpleſt. And among them, we muſt pitch vpon that, wherein is greateſt diuiſibility, and which conſequently is diuided into leaſt partes; that is, fire: ſo as we may conclude that among all the bodies in the world, that which of its owne nature hath an aptitude to be leaſt, muſt be fire.

3. The firſt coniunction of partes is in bodies of leaſt ciſe; and it is made by the force of Quantity.

Now, the leaſt body of fire, be it neuer ſo litle, is yet diuiſible into leſſe: What is it then that maketh it be one? To determine this; we muſt reſort vnto the nature of *Quantity*: whoſe formall notion and eſſence is; *To be diuiſible*, which ſignifyeth, that many may be made, of it; but thar of which many may be made, is not yet many, out of this very reaſon; that many may be made of it. But, what is not many, is one. Therefore what hath quantity; is, by meere hauing quantity, actually and formally, as well one, as it hath the poſſibility of being made

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many. And consequently, the least body of fire, by hauing quantity, hath those partes which might be many, actually one. And this is the first coniunction of partes that is to be considered in the composition of bodies: which though it be not an actuall ioyning of actuall partes; yet it is a formall coniunction of what may be many.

4. The second sort of coniunction is cõpactednesse in simple Elements, and it proceedeth from density.

In the next place we may consider; how seeing the least bodies that are, be of fire; it must needes follow, that the least partes of the other Elements must be bigger then they. And consequently, the possible partes of those least partes of the other Elements must haue something to conserue them together, more then is found in fire. And this, because Elements are purely distinguished by rarity and density is straight concluded to be *density*. And thus, we haue found; that as quantity is the cause of the possible partes being one, so density is the cause of the like partes sticking together: which appeareth in the very definition of it, for, *to be lesse diuisible*, (which is the notion of density) speaketh a resistance to diuision, or a sticking together.

5. The third coniunction is of parres of different Elements, and it proceedeth from quantity and density together.

Now lett vs examine how two partes of different Elements are ioyned together, to make a compound. In this coniunction we find both the effects we haue already touched: for, two such partes must make one; and moreouer, they must haue some resistance to diuisibility. The first of these effects we haue already assigned vnto the nature of quantity. And it being the formall effect of quantity; it can not (whersoeuer it is found) haue any other formall cause then quantity: and therefore, eyther the two litle partes of different Elements, do not become one body: or if they doe, we must agree that it is by the nature of quantity, which worketh as much in heterogeneall partes, as it doth in homogeneall ones. And it must needes do so: because Rarity and Dẽsity (which are the proper differencies of Quantity) can not change the common nature of Quantity, that is their Genus: which by being so to them, must be vniuocally in them both. And this effect cometh precisely from the pure notion of the Genus: and consequently, must be seene as well in two partes of different natures, as in two partes of the same nature: but in partes of the same nature, which once were two, and afterwardes become one; there can be no other reason why they are one, then the very same for which those partes that were neuer seperated (but that may be seperated) are likewise one: and this, most euidently, is the nature of quantity.

Experience seemeth to confirme thus much; when pouring water out of a basin, some of it will remaine sticking to the sides, of the mettall: for if the quantity of the basin, and of the water, had not beene one and the same by its owne nature; the water (considering the plyablenesse of its partes) would certainely haue commen all away, and haue glided from the vneuennesse of the basin, by the attractiue vnity of its whole, and would haue preserued the vnity of its quantity within it selfe, rather then by sticking to the basin, haue suffered diuision in its owne quantity; which

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which we are ſure was one, whiles the water was altogether in the baſin: but that, both the baſin and the water making but one quantity; and a diuiſion being vnauoydable in that one quantity; it was indifferent, in regard of the quantity conſidered ſingly by it ſelfe, where this diuiſion should be made, whether in the partes of the baſin, or in the partes of the water: and then, the other circumſtances determined it in that part of the water which was neereſt to the ioyning of it with the baſin.

The ſecond effect (which was reſiſtance to diuiſibility;) we aſſigned vnto denſity. And of that ſame cauſe, muſt alſo depend the like effect in this caſe of the ſticking together of the two partes of different Elements, when they are ioyned to one an other: for if the two partes, whereof one is denſe, the other is rare, do not exceede the quantity of ſome other part of one homogeneall rare Element for the diuiding whereof, ſuch a determinate force, and no leſſe can ſuffice: then, ſeeing that the whole compoſed of theſe two partes is not ſo diuiſible as the whole conſiſting of that one part; the aſſigned force will not be able to diuide them. Wherefore it is plaine, that if the rare part had beene ioyned to an other rare part in ſteed of the denſe one it is ioyned vnto; it had beene more eaſily diuidable from that, then now it is from the denſe part. And by conſequence it ſticketh more cloſely to the denſe part, then it would to an other of its owne nature.

6. The reaſon why liquide bodies do eaſily ioyne together; and dry ones difficultly.

Out of what we haue ſaid, a ſteppe is made vs to vnderſtand why ſoft and liqnid bodies do eaſily ioyne and incorporate into one continued body; but hard and dry bodies ſo difficultly, as by experience we find to be true. Water with water, or wine eyther with other wine or with water, ſo vniteth, that it is very hard to part them: but ſand or ſtones can not be made to ſticke together without very great force and induſtry. The reaſons whereof, muſt neceſſarily depend of what we haue ſaid aboue. To witt that two bodies can not touch one an other, without becoming one: and, that if two bodies of one degree of denſity do touch, they muſt ſticke together according to the force of that degree of denſity. Out of which two, is manifeſtly inferred, that if two hard thinges, should come to touch, they muſt needes be more difficultly ſeperated then two liquid thinges. And conſequently, they can not come to touch, without as much difficulty, as that whereby they are made one.

7. That no two hard bodies can touch one an other immediately.

But to deduce this more particularly; lett vs conſider, that all the litle ſurfaces, by which one hard body may be conceiued to touch an other (as for example, when a ſtone lyeth vpon a ſtone) muſt of neceſſity be eyther plane, or concaue, or conuexe. Now if a plane ſuperficies should be ſuppoſed to touch an other plane one coming perpendicularly to it; it muſt of neceſſity be granted to touch it as ſoone in the middle as on the ſides. Wherefore, if there were any ayre (as of neceſſity there muſt be) betwixt the two ſurfaces before they touched; it will follow that the ayre which was in the middle, muſt haue fled quite out from betweene the two ſurfaces, as ſoone as any part of the ſurfaces do touch; that is, as

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ſooneas the ayre which was betweene the vtmoſt edges of the ſurfaces did fly out; and by conſequence it muſt haue moued in an inſtant.

But if a plane ſurface be ſaid to touch a conuexe ſurface; it toucheth it onely by a line, (as Mathematicans demonſtrate) or onely by a point. But, to touch by a line or a point, is in truth, not to touch by the forme or notion of Quantity, (which requireth diuiſibility in all that belongeth vnto it;) and dy conſequence among bodies it is not to touch; and ſo, one ſuch ſurface doth not touch the other.

Now, for a plaine ſurface to touch a concaue; euery man ſeeth is impoſſible. Likewiſe, for two cõuexe ſurfaces to touch one an other, they muſt be allowed to touch eyther in a line or in a point, which we haue shewed not to be a phyſicall touching. And if a conuexe ſurface should bee ſaid to touch a concaue; they muſt touch all att once as we ſaid of plane ſurfaces; and therefore the ſame impoſſibility will ariſe therein: ſo that it is euident, that no two ſurfaces, mouing perpendicularly towardes one an other, can come to touch one an other, if neyther of them yieldeth, and changeth its hew.

Now then, if it be ſuppoſed that they come ſlidingly one oueran other in the ſame line; whereby, firſt the very tippes of the edges come to touch one an other; and ſtill as you shooue the vpermoſt on forwardes, and that it ſlideth ouer more of the nether ſurface, it gaineth to touch more of it. I ſay that neither in this caſe do they touch immediately one an other: for as ſoone as the two firſt partes should meete, if they did touch, and that there were no ayre betweene them; they muſt preſently become one quantity or body, as we haue declared; and muſt ſticke firmely together, according to their degree of denſity; and cõſequently, could not be moued on, without ſtill breaking a sũder att euery impulſe, as much of the maſſy body, as were already made one by their touching.

And if you should ſay they did not become one; and yet allow them to touch immediately one an other without hauing any ayre or fluide body betweene them; then if you ſuppoſe them to moue onwardes vpon theſe termes; they would be changed locally, without any intrinſecall change: which in the booke De Mundo (as we haue formerly alleadged) is demonſtrated to be impoſſible.

There remayneth onely a third way for two hard ſurfaces to come together; which is, that firſt they should reſt ſloaping one vpon an other, and make an angle where they meete (as two lines, that cutt one an other, do in their point of their interſection) and ſo containe as it were a wedge of ayre betweene them, which wedge they should leſſen by litle and litle, through their mouing towardes one an other att their moſt diſtant edges (whiles the touching edges, are like immoueable centers that the others turne vpon) till att length they shutt out all the ayre, and cloſe together, like the two legges of a compaſſe.

But neither is it poſſible that this way they should touch, for after their firſt touch by one line (which neyther is in effect a touching, as we haue shewed)

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shewed)no other partes of them can touch, though ſtill they approach neerer and neerer, vntill their whole ſurfaces do entirely touch att once: and therefore, the ayre muſt in this caſe leap out in an inſtant a greater ſpace, then if the ſurfaces came perpendicularly to one an other; for here it muſt fly from one extremity to the other: whereas, in the former caſe, it was to goe but from the middle to each ſide.

And thus it is euident, that no two bodies can arriue to touch one an other, vnleſſe one of them att the leaſt, haue a ſuperficies plyable to the ſuperficies of the other; that is, vnleſſe one of them be ſoft, which is, to be liquide in ſome degree. Seeing then, that by touching, bodies do become one; and that liquidity, is the cauſe and meanes whereby bodies arriue to touch; we may boldly conclude that two liquide bodies do moſt eaſily and readily become one; and next to two ſuch, a liquide and a hard body, are ſooneſt vnited: but two hard ones moſt difficultly.

8. How mixed bodies are framed in generall.

To proceede then with our reflections vpon the compoſition of bodies, and vpon what reſulteth out of the ioyning and mixture of their firſt differences Rarity and Denſity; we ſee, how if a liquide ſubſtance happeneth to touch a dry body it ſticketh eaſily therevnto. Then conſider, that there may be ſo ſmall a quantity of ſuch a liquide body, as it may be almoſt impoſſible for any naturall agent to diuide it further into any leſſe partes; and ſuppoſe that ſuch a liquide part is betweene two dry partes of a denſe body, and ſticking to them both, becometh in the nature of a glew to hold them together: will it not follow out of what wee haue ſaid, that theſe two denſe partes will be as hard to be ſeuered from one an other, as the ſmall liquide part by which they ſticke together is to be diuided? So that, when the viſcous ligaments which in a body do hold together the denſe partes, are ſo ſmall and ſubtile, as no force we can apply vnto them can diuide them, the adheſion of the partes muſt needes grow then inſeparable. And therefore, we vſe to moyſten dry bodies, to make them the more eaſily be diuided; whereas thoſe that are ouermoyſt, are of themſelues ready to fall in pieces. And thus you ſee how in generall, bodies are framed.

9. The cauſe of the ſeuerall degrees of ſolidity in mixed bodies.

Out of which diſcourſe, we may ballance the degrees of ſolidity in bodies, for all bodies being compoſed of humide and dry partes, we may conceiue either kind of thoſe partes, to be bigger or leſſer, or to be more rare or more denſe. Now if the dry partes of any body, be extreme litle and denſe; and the moyſt partes that ioyne the dry ones together, be very great and rare; then that body will be very eaſy to be diſſolued. But if the moyſt partes which glew together ſuch extreme litle and denſe dry partes, be eyther leſſer in bulke or not ſo rare; then the body compoſed of them will be in a ſtronger degree of conſiſtence. And if the moyſt partes which ſerue for this effect; be in an exceſſe of littleneſſe and withall denſe; then, the body they compoſe will be in the higheſt degree of conſiſtence that nature can frame.

On the other ſide; if you glew together great dry partes, which are

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moderately denſe and great; by the admixtion of humide partes that are of the leaſt ciſe in bulke, and denſe withall; then the conſiſtence will decreaſe from the height of it by how much the partes are greater, and the denſity leſſe. But if vnto dry partes of the greateſt ciſe, and in the greateſt remiſſeneſſe of denſity, you adde humide partes that are both very great and very rare, then the compoſed body will proue the moſt eaſily diſſolueable of all that nature affordeth.

10. The rule wherevnto are reduced all the ſeuerall combinations of Elements in compounding of mixed bodies.

After this, caſting our eyes a litle further towardes the compoſition of particular bodies; wee shall find ſtill greater mixtures, the further we goe; for as the firſt and ſimpleſt compounded bodies, are made of the foure Elements; ſo, others are made of theſe; and againe a third ſort of them: and ſo, onwardes, according as by motion, the partes of euery one are broken in ſunder, and mingled with others. Thoſe of the firſt order, muſt be of various tempers according to the proportions of the Elements, whereof they are immediately made. As for example, ſuch a proportion of fire to the other three Elements, will make one kind of ſimple body, and an other proportion will make an other kind: and ſo throughout, by various combinations and proportions among all the Elements.

In the effecting of which worke, it will not be amiſſe to looke a litle vpon nature; and obſerue how she mingleth and tempereth different bodies one with an other, whereby she begetteth that great variety of creatures which we ſee in the world. But becauſe the degrees of compoſition are infinite, according to the encreaſe of number, we will containe our ſelues within the common notions of exceſſe in the foure primary componentes, for if we should deſcend once to ſpecify any determinate proportions, we should endanger looſing our ſelues in a wood of particular natures, which belong not to vs att preſent to examine. Then taking the foure Elements as materials to worke vpon: lett vs firſt conſider how they may be varyed, that differing compoſitions may reſult out of their mixtures. I conceiue that all the wayes of varying the Elements in this regard, may be reduced to the ſeuerall ciſes of bigneſſe, of the partes of each Element, that enter into the compoſition of any body, and to the number of thoſe partes: for certainely no other can be imagined, vnleſſe it were variety of figure.

But that can not be admitted to belong in any conſtant manner to thoſe leaſt particles where of bodies are framed; as though determinate figures were in euery degree of quantity due to the natures of Elements, and therefore, the Elements would conſerue themſelues in thoſe figures, as well in their leaſt atomes, as in maſſye bulke: for ſeeing how theſe litle partes are shuffled together without any order; and that all liquids eaſily ioyne, and take the figures which the denſe ones giue them; and that they againe, iuſtling one an other, do crush themſelues into new shapes, which their mixture with the liquide ones, maketh them yield the more eaſily vnto: it is impoſſible that the Elements should haue any other

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naturall figure in theſe their leaſt partes, then ſuch as chance giueth them. But that one part muſt be bigger then an other is euident; for the nature of rarity and denſity giueth it: the firſt of them, cauſing diuiſibility into litle partes, and the latter, hindering it.

Hauing then ſettled in what manner the Elements may be varied in the compoſition of bodies: lett vs now beginne our mixture. In which, our ground to worke vpon muſt be earth and water; for onely theſe two are the baſis of permanent bodies, that ſuffer our ſenſes to take hold of them, and that ſubmitt themſelues to tryall: whereas, if we should make the predominant Element to be ayre or fire, and bring in the other two ſolide ones vnder their iuriſdiction to make vp the mixture, the compound reſulting out of them, would be eyther in continuall conſumption, (as ordinary fire is) or elſe imperceptible to our eyes or touch, and therefore, not a fitt ſubiect for vs to diſcourſe of, ſince the other two afford vs enough to ſpeculate vpon. Peraduenture our ſmell migh take ſome cogniſance of a body ſo compoſed, or the effect of it taken in by reſpiration, might in time shew it ſelfe vpon our health: but it concerneth not vs now to look ſo farre; our deſigne requireth more maniable ſubſtances.

11. Earth and water are the baſis of all permanent mixed bodies.

Of which, lett water be the firſt; and with it we will mingle the other three Elements, in exceſſe ouer one an other by turnes; but ſtill, all of them ouerſwayed by a predominant quantity of water: and then, lett vs ſee what kind of bodies will reſult out of ſuch proportions. Firſt, if earth preuayle aboue fire and ayre, and arriue next in proportion to the water, a body of ſuch a compoſition, muſt needes prooue hardly liquide, and not eaſy to lett its partes runne a ſunder, by reaſon of the great proportion of ſo denſe a body as earth that holdeth it together. Yet ſome inclination it will haue to fluidneſſe, by reaſon the water is predominant ouer all; which alſo will make it be eaſily diuiſible, and giue very litle reſiſtance to any hard thing that shall be applyed to make way through it. In a word, this mixture maketh the conſtitution of mudde, durt, honey, butter and ſuch like thinges where the maine partes are great ones. And ſuch, are the partes of earth and water in themſelues.

12. What kind of bodies thoſe are where water is the baſis, and earth the predominant Element ouer the other two.

Lett the next proportion of exceſſe in a watry compound, be of ayre, which when it preuayleth, it incorporateth it ſelfe chiefely with Earth, for the other Elements would not ſo well retaine it. Now, becauſe its partes are ſubtile (by reaſon of the rarity it hath) and ſticking, (becauſe of its humidity) it driueth the Earth and water likewiſe into leſſer partes. The reſult of ſuch a mixture is, that the partes of a boby compounded by it are cloſe, catching, flowing ſlowly, glibbe, and generally it will burne, and be eaſily conuerted into flame.

13. Of thoſe bodies, where water being the baſis ayre is the predominant Element.

Of this kind, are thoſe which we call oyly or vnctuous bodies whoſe great partes are eaſily ſeparated, (that is, they are eaſily diuiſible in bulke,) but the ſmall ones very hardly. Next the ſmallneſſe, and well

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working of the partes, by meanes of the ayres penetrating euery denſe one, and ſticking cloſe to euery one of them, and conſequently, ioyning them without any vneuenneſſe; cauſeth that there can be no ruggedneſſe in it; and therefore, it is glibbe: in like manner as we ſee plaſter or ſtarch become ſmooth when they are well wrought. Then, the humidity of it cauſeth it to be catcking, and the ſhorteneſſe of euery part, maketh that where it ſticketh, it is not eaſily parted thence. Now, the rarity of ayre next vnto fire, admitteth it to be (of all the other Elements) moſt eaſily, brought to the height of fire, by the operation of fire vpon it. And therefore, oyles are the proper foode of that Element. And accordingly we ſee, that if a droppe of oyle be ſpilled vpon a sheete of paper, and the paper be ſett on fire att a corner; as the fire cometh neere the oyle, the oyle will diſperſe and ſpread it ſelfe vpon the paper to a broader compaſſe then it had; which is, becauſe the heat rarifyeth it; and ſo, in oyle it ſelfe the fire rarifying the ayre, maketh it penetrate the earthy partes adioyned vnto it, more then it did; and ſo ſubtiliſeth them, till they be reduced to ſuch a height as they are within the power of fire to communicate his owne nature vnto them: and thus, he turneth them into fire, and carrieth them vp in his flame.

14. What kind of bodies reſult, where water is the baſis and fire the predominant Element.

But if fire be predominant ouer earth and ayre in a watry compound; it maketh the body ſo proportioned, to be ſubtile, rare, penetratiue, hoat in operation, light in weight, and ſubiect to burne. Of this kind are all ſortes of wines, and diſtilled ſpirits, commonly called ſtrong waters or Aquauites; in latine Aquæ ardentes. Theſe will looſe their vertues meerely by remaining vncouered in the ayre; for fire doth not incorporate ſtrongly with water; but, if it find meanes, rayſeth it ſelfe into the ayre; as we ſee in the ſmoake of boyling water which is nothing elſe but litle bodies of fire, that entring into the water, do rarify ſome partes of it; but haue no inclination to ſtay there and therefore as faſt as they can gett out, they fly away; but the humide partes of the water, which they haue rarifyed (being of a ſticking nature) do ioyne themſelues vnto them, and aſcend in the ayre as high as the fiery atomes haue ſtrength to carry them: which when it faileth them, that ſmoake falleth downe in a dew, and ſo becometh water againe as it was. All which one may eaſily diſcerne in a glaſſe veſſell of water ſett ouer the fire; in which one may obſerue the fire come in att the bottome, and preſently ſwimme vp to the toppe like a litle bubble, and immediately riſe from thence in ſmoake: and that, will att laſt conuert it ſelfe into droppes and ſettle vpon ſome ſolide ſubſtance thereabouts.

Of theſe fyry ſpirits, ſome are ſo ſubtile, as of themſelues they will vanish, and leaue no reſidue of a body behind them; and Alchymiſtes profeſſe to make them ſo etheriall and volatile, that being poured out of a glaſſe from ſome reaſonable height, they ſhall neuer reach the ground: but that before they come thither, they will be ſo rarifyed by that litle motion, as they ſhall grow inuiſible like the ayre, and diſperſing themſelues

themſelues all about in it, they will fill the chamber with the ſmell of that body which can no longer be ſeene.

15. Of thoſe bodies, where water is in exceſſe, it alone being both the baſis, and the predominant Element.

The laſt exceſſe in watry bodies, muſt be of water it ſelfe, which is, when ſo litle a proportion of any of the other is mingled with it, as is hardly perceptible: out of this compoſition do ariſe all thoſe ſeuerall ſortes of iuices or liquors, which we commonly call waters: which by their mixture with the other three Elements, haue peculiar properties beyond ſimple Elementall water. The generall qualities whereof, we ſhall not neede any further to expreſſe, becauſe, by what we haue already ſaid of water in cõmon, they are ſufficiently knowne.

16. Of thoſe bodies where Earth alone is the baſis, and alſo the predominant in exceſſe ouer the other three Elements.

In our next ſuruay, we will take earth for our ground to worke vpon, as hitherto we haue done water: which if in any body, it be in the vtmoſt exceſſe of it beyond all the other three; then, rockes and ſtones will grow out of it; whoſe dryeneſſe ad hardneſſe may aſſure vs, that Earth ſwayeth in their compoſition, with the leaſt allay that may be. Nor doth their lightneſſe (in reſpect of ſome other Earthy compoſitions) impeach this reſolution; for that proceedeth from the greatneſſe and multiplicity of pores; wherewith their dryeneſſe cauſeth them to abound and hindereth not, but that their reall ſolide partes may be very heauy.

17. Of thoſe bodies where Earth is the baſis, and water the predominãt Element ouer the other two.

Now if we mingle a conſiderable proportion of water with earth; ſo, as to exceede the fire and ayre, but ſtill inferior to the earth; we ſhall produce mettalls: whoſe great weight, with their ductility and malleability, plainely telleth vs, that the ſmalleſt of waters groſſe partes, are the glew that holdeth the earthy denſe ones together: ſuch weight, belonging to earth, and that eaſye changing of partes, being moſt proper to water. Quickeſiluer (that is the generall matter, whereof all the mettalls are immediately cõpoſed) giueth vs euidence hereof; for fire worketh vpon it with the ſame effect as vpon water. And the calcination of moſt of the mettalls, proueth that fire can eaſily part and conſume the glew by which they were cloſed and held together: which therefore, muſt be rather of a watry then of an ayry ſubſtance. Likewiſe the glibbeneſſe of Mercury, and of melted mettalls, without catching or ſticking to other ſubſtances, giueth vs to vnderſtand that this great temper of a moyſt Element with Earth, is water, and not ayre; and that the watry partes are compriſed, and as it were ſhutt vp within the earthy ones: for ayre catcheth and ſticketh notably to all thinges it toucheth, and will not be impriſoned; the diuiſibity of it being exceeding great, though in neuer ſo ſhort partes.

18. Of thoſe bodies, where earth being the baſis ayre is the predominant.

Now if ayre mingleth it ſelfe with earth, and be predominant ouer water and fire; it maketh ſuch an oyly and fatt ſoile, as husbandmen account their beſt mould; which receiuing a betterment from the ſunne and temperate heat, aſſureth vs of the concurſe of the ayre: for whereſoeuer ſuch heate is, ayre can not faile of accompanying it, or of being effected by it: and the richeſt of ſuch earth, (as pott earth and marle) will with much fire grow more compacted, and ſticke cloſer

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together then it did; as we see in baking them into pottes or fine brickes. Whereas, if water were the glew betweene the dense partes fire would consume it and crumble them a sunder, as it doth in those bodies it calcineth. And excesse of fire will bring them to vitrification; which still confirmeth that ayre aboundeth in them; for it is the nature of ayre to sticke so close where once it is kneaded in, as it can not be seperated without extreme difficulty. And to this purpose, the viscous holding together of the partes of glasse when it is melted, sheweth euidently that ayre aboundeth in vitrifyed bodies.

19. Of those bodies, where Earth being the basis, fire is the predominant.

The last mixture we are to meddle with, is of fire with earth, in an ouerruling proportion ouer ayre and water. And this I conceiue produceth those substances, which we may terme coagulated iuices, and which the latines do call *Succi concreti*: whose first origine, seemeth to haue beene liquors; that haue beene afterwardes dryed by the force eyther of heate, or of cold. Of this nature are all kind of saltes, niters sulfurs, and diuers sortes of bitumens. All which, easily bewray the relikes an deffects of fire left in them; some more', some lesse, according to their degrees.

20. All the second qualities of mixed bodies, arise from seuerall combinations of the first qualities: and are att last resolued into seuerall degrees of rarity and density.

And thus, we haue in generall, deduced from their causes, the complexions of those bodies, whereof the bulke of the world subiected to our vse, consisteth; and which serue for the production and nourishment of liuing creatures, both animall and vegetable. Not so exactly (I confesse) nor so particularly, as the matter in it selfe, or as a treatise confined to that subiect, would require: yet sufficiently for our intent. In the performance whereof, if more accurate searchers of nature shall find that we haue peraduenture beene mistaken in the minute deliuering of some particular bodies complexion; their very correction (I dare boldly say) will iustify our principall scope: which is, to shew that all the great variety we see among bodies, ariseth out of the cõmixtion of the first qualities and of the Elements: for they will not be able to correct vs, vpon any other groundes then those we haue layed.

As may easily be perceiued, if we cast a summary view vpon the qualities of composed bodies. All which we shall find to spring out of rarity, and density, and to sauour of their origine: for the most manifest qualities of bodies may be reduced to certaine paires opposite to one an other. As namely some are liquide and flowing, others are consistent; some are soft others hard; some are fatty, viscous, and smooth; others leane, gritty, and rough; some grosse, othert subtile; some tough, others brittle: and the like. Of which the liquide, the soft, the fatt and the viscous, are so manifestly deriued from rarity, that we neede not take any further paines to trace out their origine: and the like is of their contraries, from the contrary cause; to witt of those bodies that are consistent, hard, leane, and gritty, all which do euidently spring from density. As for smoothnesse, we haue already shewed how that proceedeth from an ayry or oyly nature; and by consequence, from a certaine degree of rarity. And therefore roughnesse (the contrary of it)

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muſt proceede from a proportionable degree of denſity. Toughneſſe, is alſo a kind of ductility, which we haue reduced to watryneſſe, that is, to an other degree of rarity; and conſequently brittleneſſe muſt ariſe from the contrary degree of denſity. Laſtly, groſſeneſſe and ſubtileneſſe do conſiſt in a difficulty or facility to be diuided into ſmall partes, which appeareth to be nothing elſe, but a certaine determination of rarity and denſity. And thus, we ſee; how the ſeuerall complexions of bodies, are reduced to the foure Elements that compound them: and the qualities of thoſe bodies, to the two primary differencies of quantatiue thinges by which the Elements are diuerſifyed.

21. That in the planets and ſtarres, there is a like varietv of mixed bodies cauſed by light as here vpon Earth.

And out of this diſcourſe it will be euident, that theſe complexions and qualities, though in diuerſe degrees, muſt of neceſſity be found whereſoeuer there is any variation in bodies: for ſeeing there can be no variation in bodies, but by rarity and denſity; and that the pure degrees of rarity and denſity, do make heate, cold, moiſture, and dryneſſe, and (in a word) the foure Elements; it is euident, that whereſoeuer theſe is variety of bodies, there muſt be the foure Elements; though peraduenture farre vnlike theſe mixed bodies which we call Elements. And againe, becauſe theſe Elements can not conſiſt without motion; and becauſe by motion they do of neceſſity, produce mixed bodies, and forge out thoſe qualities, which we come from explicating; it muſt by like neceſſity, follow, that whereſoeuer there is any variety of actiue and paſſiue bodies; there mixed bodies likewiſe muſt reſide of the ſame kindes, and be endewed with qualities of the like natures, as thoſe we haue treated of; though peraduenture, ſuch as are in other places of the world remote from vs, may be in a degree farre different from ours.

Since then, it can not be denyed, but that there muſt be notable variety of actiue and paſſiue bodies whereſoeuer there *is light*: neyther can it be denyed, but that in all thoſe great bodies from which light is reflected vnto vs, there muſt be a like variety of complexions and of qualities, and of bodies tempered by them, as we find here in the orbe we liue in. Which ſyſteme; how different it is from that which Ariſtotle and the moſt of the ſchoole haue deliuered vs, as well in the euidencies of the proofes for its being ſo; as in the poſition and modell of it; I leaue vnto the prudent readers to conſider and iudge.

22. In what māner the Elements do worke vpon one an other, in the compoſitiō of mixed bodies: and in particular fire which is the moſt actiue.

Out of what hath beene already ſaid, it is not hard to diſcouer in what manner the compoſition of bodies is made. In effecting of which; the maine hinge whereon that motion depēdeth, is fire or heate; as it likewiſe is, in all other motions whatſoeuer. Now becauſe the compoſition of a mixed body proceedeth from the action of one ſimple body or element vpon the others: it will not be amiſſe to declare by ſome example how this worke paſſeth: for that purpoſe, lett vs examine how fire or heate worketh vpon his fellowes.

By what we haue formerly deliuered; it is cleare that fire ſtreaming out from its center, and diffuſing it ſelfe abroad, ſo as to fill the

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circumference of a larger circle, it muſt needes follow, that the beames of it are moſt condenſed and compacted together neere the center; and the further they ſtreame from the center, the more thinne and rarifyed they muſt grow: yet this is with ſuch moderation, as we can not any where diſcerne that one beame doth not touch an other; and therefore, the diſtances muſt be very ſmall. Now lett vs ſuppoſe that fire happeneth to be in a viſcous and tenacious body; and then conſider what will happen in this caſe: of one ſide, the fire ſpreadeth it ſelfe abroad; on the other ſide, the partes of the tenacious body being moiſt (as we haue formerly determined) their edges on all handes will ſticke faſt to the dry beames of the fire that paſſe betweene them. Then they ſtretching wider and wider from one an other muſt needes draw with them the partes of that tenacious body which ſticke vnto them; and ſtertch them into a greater wideneſſe or largeneſſe then they enioyed before, frō whēce it followeth, that (ſeeing there is no other body neere thereaboutes, but they two) eyther there muſt be a vacuity left, or elſe the tenacious body muſt hold and fill a greater ſpace then it did before; and conſequently be more rare.

Contrarywiſe, if any of the other Elements be ſtronger then fire, the denſer Elements breake off, from their continued ſtreame, the little partes of fire, which were gotten into their greater partes: and ſticking on all ſides about them, they do ſo encloſe them that they haue no more ſemblance of fire: and if afterwardes by any accident there cometh a great compreſſion, they force them to looſe their naturall rarity, and to become ſome other Element. Thus it fareth with fire, both in acting and in ſuffering. And the ſame courſe, we haue in both theſe regardes expreſſed of it, paſſeth likewiſe in the reſt of the Elements to the proportion of their contrarieties.

Hence it followeth, that when fire meeteth with humidity in any body, it diuideth and ſubtiliſeth it, and diſperſeth it gently, and in a kind of equall manner through the whole body it is in, (if the operation of it be a naturall and a gentle one) and ſo driueth it into other partes, which att the ſame time it prepareth to receiue it by ſubtiliſing likewiſe thoſe partes. And thus moderate fire, maketh humour in very ſmall partes to incorporate it ſelfe in an euen or vniforme manner with the dry partes it meeteth withall: which being done whether the heate doth afterwardes continue, or that cold ſucceedeth in lieu of it, the effect muſt of neceſſity be, that the body thus compoſed, be bound vp and faſtened, more or leſſe according to the proportion of the matter it is made of, and of the Agents that worke vpon it, and of the time they employ about it. This is euery day ſeene, in the ripening of fruites and in other frequent workes, as well of art as of nature, and is ſo obuious; and ſenſible to any reaſonable obſeruation that it is needeleſſe to enlarge my ſelfe much vpon this ſubiect.

23. A particular declaration touching the generation of mettalls.

Onely, it will not be amiſſe, for examples ſake, to conſider the progreſſe of it in the compoſing or augmenting of mettalls, or of earths of diuers

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ſorts: firſt heate(as we haue ſaid) draweth humour out of all the bodies it worketh vpon: then if the extracted humour be in quantity and the ſteames of it do happen to come together in ſome hollow place fitt to aſſemble them into greater partes; they are condenſed and they fall downe in a liquide and running body. Theſe ſteames being thus corporifyed, the body, reſulting out of them, maketh it ſelfe in the earth a channell to runne in: and if there be any looſe partes in the channell, they mingle themſelues with the running liquor: and though there be none ſuch, yet in time the liquor it ſelfe looſeneth the channell all about, and imbibeth into its owne ſubſtãce the partes it raiſeth. And thus, all of them compacted together, do roule along till they tumble into ſome low place, out of which they can not ſo eaſily gett to wander further. When they are thus ſettled, they do the more eaſily receiue into them, and retaine ſuch heate as is euery where to be mett withall, becauſe it is diffuſed more or leſſe through the earth. This heate, if it be ſufficient, digeſteth it into a ſolide body: the temper of cold likewiſe concurring in its meaſure to this effect. And according to the variety of the ſubſtances whereof the firſt liquour was made, and which it afterwardes drew along with it; the body that reſulteth out of them is diuerſifyed.

In confirmation of all which, they that deale in mines, tell vs they vſe to find mettalls oftentimes mingled with ſtones; as alſo, coagulated iuices with both; and earths of diuers natures, with all three; and they with it, and one with an other among themſelues. And that ſometimes they find the mines not yet conſolidated and digeſted throughly into mettall; when by their experience knowing after how many yeares they will be ripe, they shutt them vp againe till then.

Now if the hollow place wherein the body ſtayed (which att the firſt was liquid and rouling) be not att once filled by it, but it taketh vp onely part of it; and the ſame liquor continueth afterwardes to flow thither: then this body is augmented, and groweth bigger and bigger. And although the liquors should come att ſeuerall times; yet, they become not therefore two ſeuerall bodies, but both liquors do grow into one body; for the wett parts of the aduentitious liquor, do mollify the ſides of the body already baked; and both of them being of a like temper and cognation, they eaſily ſticke and grow together.

Out of this diſcours it followeth euidently, that in all ſortes of compounded bodies whatſoeuer, there muſt of neceſſity, be actually compriſed ſundry partes of diuers natures: for otherwiſe, they would be but ſo many pure degrees of rarity and denſity; that is, they would be but ſo many pure Elements, and each of them haue but one determinate vertue or operation.

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THE FIFTEENTH CHAPTER.

Of the dissolution of Mixed bodies.

1. why some bodies are brittle, and others tough, or apt to withstand outward violence, the first instrument to dissolue mixed bodies.

THus much for composition of bodies. Their dissolution is made three wayes: eyther by fire, or by water, or by some outward violence. We will beginne with examining how this last is done. To which end we may consider, that the vnity of any body consisting in the connexion of its partes; it is euident that the force of motion, if it be exercised vpon them, must of necessity separate them, as we see in breaking, cutting, filing, drawing a sunder, and the like.

All these motions, because they are done by grosse bodies, do require great partes to worke vpon, and are easily discerned how they worke: so that it is not difficult to find the reason why some hard bodies breake easily, and others with much adoe. The first of which are called brittle, the others tough. For if you marke it, all breaking requireth that bẽding hould precede: which on the one side compresseth the partes of the bended body, and condenseth them into a lesser roome then they possessed before; and on the other side stretcheth them out, and maketh them take vp more place. This requireth some fluide or moueable substance to be within the body; else, it could not be done; for without such helpe, the partes could not remoue. Therefore such hard bodies as haue most fluide partes in them, are most flexible, that is are toughest. And those which haue fewest, though they become thereby hardest to haue impression made vpon them, yet if the force be able to do it, they rather yield to breake then to bend; and thence, are called brittle.

Out of this we may inferre, that some bodies may be so soddainely bent as that thereby they breake asunder; whereas if they were leisurely and gently dealed withall, they would take what ply one desireth. And likewise that there is no body (be it neuer so brittle and hard) but that it will bend a litle (and indeed more then one would expect) if it be wrought vpon with time and dexterity; for there is none but cõtaineth in it some liquide partes, more or lesse: euen glasse and bricke. Vpon which occasion I remember, how once in a great storme of wind, I saw the high slender bricke chimnyes of the Kinges house att St Iames (one winter when (the ourt lay there) bend from the wind like bowes, and sharke exceedingly, and totter. And at other times I haue seen some very high, and pointy spire steeples do the like. And I haue beene assured the like of the whole pile of a high castle, standing in a gullett in the course of the wind; (namely the castle of Wardour) by those who haue often seene it shake notably in a fierce wind.

The reason of all which may be deduced out of what we haue said aboue: for seeing that the bending of a body, maketh the spirits or humors that are within it, to sally forth; it is cleare that if the violence

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which forceth it, be not ſo ſoddaine, nor the motion it receiueth, be not ſo quicke, but that the moiſture may ooſe gently out; the body will bend, ſtill more and more, as their abſence giueth it leaue. But if the motion that is wrought in it be too quicke; then the ſpirits not hauing time allowed them to goe leiſurely and gently out, do force their priſon, and breake out with a violence; and ſo the body is ſnapped into two.

2. How outward violence doth worke vpon the moſt compacted bodies.

Here peraduenture ſome remembring what we haue ſaid in an other place; namely, that it is the shorteneſſe and littleneſſe of the humide partes in a body, which maketh it ſticke together; and that this shorteneſſe may be in ſo high a degree, as nothing can come betweene the partes they glew together to diuide them; may aske how a very denſe body of ſuch a ſtraine, can be broken or diuided? But the difficulty is not great, for ſeeing that the humide partes, in whatſoeuer degree of shorteneſſe they be, muſt neceſſarily haue ſtill ſome latitude; it can not be doubted, but there may be ſome force aſſigned, greater then their reſiſtance can be. All the queſtion is, how to apply it to worke its effect vpon ſo cloſe a compacted body, in which peraduenture the continuity, of the humide partes that bind the others together, may be ſo ſmall, as no other body whatſoeuer (no, not fire) can goe betweene them, in ſuch ſort as to ſeparate part from part. Att the worſt, it can not be doubted but that the force may be ſo applyed att the outſide of that body, as to make the partes of it preſſe, and fight one againſt an other, and att the length, by multiplication of the force, conſtraine it to yield and ſuffer diuiſion. And this I conceiue to be the condition of gold and of ſome pretious ſtones: in which the Elements are vnited by ſuch little partes, as nothing but a ciuill warre within themſelues (ſtirred vp by ſome ſubtile outward enemy, whereby they are made to teare their owne bowels) could bring to paſſe their deſtruction.

But this way of diſſoluing ſuch bodies, more properly belongeth to the next way of working vpon them by fire: yet the ſame is done when ſome exterior violence preſſing vpon thoſe partes it toucheth, maketh them cutt a way betweene their next neighbours; and ſo continuing the force, diuide the whole body. As when the chiſell, or euen the hammer with beating, breaketh gold a ſunder: for it is neyther the chiſell, nor the hammer that doth that effect immediately; but they make thoſe partes they touch, cutt the others that they are forced vpon. In ſuch ſort as I remember happened to a gentleman that ſtood by me (in a ſea fight I was in) with a coate of maile vpon his body, when a bullett coming againſt a bony part in him, made a great wound, and shattered all the bones neere where it ſtrucke: and yet the coate of maile was whole: it ſeemeth the little linkes of the maile yielding to the bullets force made their way into the flesh and to the bone.

3. The ſeuerall effects of fire, the ſecond and chiefeſt inſtrumēt to diſſolue all cōpounded bodies.

But now it is time to come to the other two inſtruments of ſeparation of bodies; fire and watet; and to examine how they diſſolue compounds. Of theſe two; the way of working of fire, is the eaſieſt

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and moſt apparant to be diſcerned. We may readily obſerue how it proceedeth, if we but ſett a piece of wood on fire; in which it maketh little holes as if with bodkins it pierced it. So that the manner of its operation, in common, being plaine, wee neede but reflect a little vpon the ſeuerall particular degrees of it. Some bodies it ſeemeth not to touch; as clothes made of Asbeſtus; which are onely purifyed by it. Others, it melteth, but conſumeth not; as gold. Others it turneth into pouder ſuddainely diſſoluing their body; as lead, and ſuch mettalls as are calcined by pure fire. Others againe, it ſeperateth into a greater number of differing partes; as into ſpirits, waters, oyles, ſalts, earth and glaſſe: of which ranke are all vegetables. And laſtly, others it conuerteth into pure fire, as ſtrong waters, or Aquauites (called aquæ ardentes) and ſome pure oyles: for the ſmoake that is made by their ſetting on fire, and peraduenture their ſalt, is ſo little as is ſcarce diſcernable. Theſe are in ſumme the diuiſions which fire maketh vpon bodies, according to the nature of them, and to the due application of it vnto them: for by the helppe and mediation of other thinges, it may peraduenture worke other effects.

4. The reaſon why ſome bodies are not diſſolued by fire.

Now to examine a little in particular, how the ſame fire, in differing ſubiects produceth ſuch defferent effects:

Limus vt hic dureſcit, & hæc vt cera liqueſcit,
Vno eodemque igni;

We will conſider the nature of euery one of the ſubiects apart by it ſelfe. Firſt, for the Asbeſtus: it is cleare, that it is of a very dry ſubſtance; ſo that to looke vpon it, when it is broken into very little pieces, they ſeeme to be little bundles of short haires, the liquidity within, being ſo little as it affordeth the partes neyther length nor breadth: and therefore, fire meeteth with litle there, that it can dilate. But what it can not dilate, it can not ſeparate; nor carry away any thing of it, but what is accidentally adherẽt vnto the outſides of it. And ſo it ſeemeth onely to paſſe through the pores, and to cleãſe the litle thriddes of it: but bringeth no detriment att all to the ſubſtance of it. In this I ſpeake onely of an ordinary fire: for I doubt not but ſuch a one it might be, as would perfectly calcine it.

5. The reaſon why fire melteth gold, but can not conſume it.

The next body we ſpoke of is gold. This aboundeth ſo much in liquidity, that it ſticketh to the fire, if duely applyed: but its humidity is ſo well vnited to its earthy partes, and is ſo perfectly incorporated with thẽ; as it can not carry away one, without likewiſe carrying away both: but both, are too heauy a weight for the litle agile partes of fire to remoue. Thus, it is able to make gold ſwell; as we ſee in melting it: in which, the gold receiueth the fire into its bowels and retaineth it a lõg time with it: but at its departure, it permitteth the fire to carry nothing away vpon its winges: as is apparant, by the goldes no whitt decay of weight, after neuer ſo long fuſion. And therefore, to haue fire make any ſeparation in gold; requireth the aſſiſtance of ſome other moyſt body, that an the one ſide may ſticke cloſely to the gold, when the fire driueth it into it, and on the other ſide may be capable of dilatation, by the action of the fire vpon it. As in ſome ſort we ſee in ſtrong waters made of ſaltes, which are a proper

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ſubiect for the fire to dilate, who, by the aſſiſtance of fire, mingling themſelues cloſely with litle partes of the gold, do pull them away from their whole ſubſtãce, and do force them to beare them cõpany in their iourny vpwardes, in which, multitudes of litle partes of fire, do concurre to preſſe thẽ on and haſtẽ thẽ: and ſo, the weight of gold being att lẽgth ouercome by theſe two powerfull Agents (whereof one ſupplyeth, what the other wanteth) the whole ſubſtance of the metall, is in litle atomes diffuſed through the whole body of the water. But this is not truly a diſſolution or a ſeparation of the ſubſtantiall partes of gold, one from an other: it is onely a corroſion, which bringeth it into a ſubtile pouder, (when the water and ſaltes are ſeperated from it) much like what filing (though farre ſmaller) or grinding of leafe gold vpon a porphyre ſtone, may reduce it into: for neyther the partes of the water, nor of the fire that make themſelues a way into the body of the gold; are ſmall and ſubtile enough to gett betweene the partes that compoſe the eſſence of it: and therefore, all they can attaine vnto, is to diuide it onely in his quantity or bulke; not in the compoſition of its nature.

Yet I intend not to deny, but that this is poſſible to be arriued vnto, eyther by pure fire duly applyed; or by ſome other aſſiſtance; as peraduenture, by ſome kind of Mercury: which being of a neerer cognation vnto mettalls, then any other liquor is; may happily haue a more powerfull ingreſſion into gold, then any other body whatſoeuer; and being withall very ſubiect to rarefaction, it may (after it is entered) ſo perfectly penetrate the gold, as it may ſeperate euery leaſt part of it, and ſo reduce it into an abſolute calx. But in this place I explicate no more then what ordinarily paſſeth; leauing the myſteries of this art to thoſe who profeſſe it.

6. Why leade is eaſily, conſumed and calcined by fire.

To goe on then with what we haue in hand: lead hath aboundance of water ouermingled with its earth, as appeareth by its eaſy yielding to be bent any way, and by its quiet ſtanding bent in the ſame poſition that the force which bowed it leaueth it in. And therefore, the liquide partes of lead, are eaſily ſeparated from its dry and earthy ones: and when it is melted, the very shaking of it, cauſeth the groſſe partes to deſcend, and many liquid ones to fly away with the fire: ſo that, ſuddainely it is thus conuerted into pouder. But this pouder is groſſe, in reſpect of other mettalls; vnleſſe this operation be often reiterated, or the fire more powerfully applyed, then what is iuſt enough to bring the body of the lead into pouder.

7. Why and how ſome bodies are diuided by fire into ſpirits, waters, oyles, ſaltes, and earth. And what thoſe partes are.

The next conſideration of bodies that fire worketh vpon; is of ſuch as it diuideth into ſpirits, ſaltes, oyles, waters, or phlegmes, and earth. Now theſe are not pure and ſimple partes of the diſſolued body, but new cõpounded bodies, made of the firſt by the operation of heat. As ſmoake is not pure water, but water and fire together: and therefore becometh not water, but by cooling, that is, by the fire flying away from it. So likewiſe thoſe ſpirits, ſalts, oyles, and the reſt; are but degrees of thinges,

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which fire maketh of diuers partes of the dissolued body, by seperating them one from an other, and incorporating it selfe with them. And so, they are all of them compounded of the foure Elements; and are further resoluable into them.

Yet I intend not to say that there are not originally in the body before its dissolution, some loose partes which haue the properties of these bodies that are made by the fire in the dissoluing of it: for seeing that nature worketh by the like instruments as art vseth; she must needes, in her excesses and defects, produce like bodies to what art doth in dissolution; which operation of art is but a kind of excesse in the progresse of nature: but my meaning is, that in such dissolution, there are more of these partes made by the working of fire, then were in the body before.

Now because this is the naturall and most ordinary dissolution of thinges; lett vs see in particular how it is done: suppose then that fire were in a conuenient manner applyed, to a body that hath all sortes of partes in it; and our owne discourse will tell vs, that the first effect it worketh will be, that as the subtile partes of fire do diuide, and passe through that body, they will adhere to the most subtile partes in it; which being most agile, and least bound, and incorporated to the bowels of the body, and lying (as it were) loosely scattered in it, the fire will carry them away with it. These will be the first that are seperated from the maine body; which being retained in a fitt receiuer, will by the coldenesse of the circumdant ayre grow outwardly coole themselues, and become first a dew vpon the sides of the glasse, and then still as they grow cooler, condense more and more; till att the length they fall downe congealed into a palpable liquor; which is composed (as you see) of the hoatest partes of the body, mingled with the fire that carried them out: and therefore this liquor, is very inflammable, and easily turned into actuall fire; as you see all spirits and *Aquæ ardentes* of vegetables are.

The hoat and loose partes being extracted; and the fire continuing and encreasing; those that will follow next are such, as though they be not of themselues loose; yet are easyest to be made so; and are therefore most separable. These must be humide; and those little dry partes which are incorporated with the ouerflowing humide ones in them (for no partes that we can arriue vnto, are of one pure, simple nature; but all are mixed and composed of the 4 Elements in some proportion) must be held together with such grosse glew, as the fire may easily penetrate and separate them. And then the humide partes diuided into little atomes do sticke to the lesser ones of the fire: which by their multitude of number and velocity of motion, supplying what they want of them in bulke; do carry them away with them. And thus these phlegmaticke partes fly vp with the fire and are afterwardes congealed into an insipide water: which if it haue any sauour, is, because the first ardent spirits are not totally separated from it; but some few of them remaine in it, and giue some

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ſome little life to the whole body of that otherwiſe flatt liquor.

Now thoſe partes which the fire ſeparateth next from the remaining body, after the firy and watry ones are carryed away, muſt be ſuch as it can worke vpon; and therefore muſt abound in humidity. But ſince they ſtirre not till the watry ones are gone, it is euident, that they are compoſed of many dry partes ſtrongly incorporated, and very ſubtilely mixed with the moiſt ones; and that both of them are exceeding ſmall, and are ſo cloſely and finely knitt together, that the fire hath much adoe to gett betweene them and cutt the thriddes that tye them together: and therefore, they require a very great force of fire to carry them vp. Now the compoſition of theſe, sheweth them to be aeriall: and (together with the fire that is mingled with them) they congeale into that conſiſtence which we call oyle.

Laſtly, it can not be otherwiſe but that the fire, in all this while of continuall application to the body it thus anatomiſeth, hath hardned and as it were roſted ſome partes into ſuch greatneſſe and dryneſſe as they will not fly, nor can be carried vp with any moderate heate. But, greate quantity of fire being mingled with the ſubtiler partes of his baked earth maketh them very pungent, and acrimonious in taſt: ſo, that they are of the nature of ordinary ſalt, and are ſo called; and by the helpe of water may eaſily be ſeparated, from the more groſſe partes, which then remaine a dead and vſeleſſe earth.

By this diſcourſe it is apparant, that fire hath been the inſtrument which hath wrought all theſe partes of an entire body into the formes they are in; for whiles, it carryed away the fiery partes it ſwelled the watry ones: and whiles it lifted vp them it digeſted the aeriall partes, and whiles it droue vp the oyles, it baked the earth and ſalt. Againe, all theſe retaining for the moſt part, the proper nature of the ſubſtance from whence they are extracted; it is euident, that the ſubſtance is not diſſolued; (for ſo, the nature of the whole would be diſſolued and quite deſtroyed, and extinguished in euery part) but that onely ſome partes containing the whole ſubſtance, or rather the nature of the whole ſubſtance in them, are ſeparated from other partes that haue likewiſe the ſame nature in them.

8. How water the third inſtrumẽt to diſſolue bodies, diſſolueth calx into ſalt; and ſo into Terra damnata.

The third inſtrument, for the ſeparation and diſſolution of bodies, is water. Whoſe proper matter to worke vpon, is ſalt. And it ſerueth to ſupply what the fire could not performe, which is the ſeparation of the ſalt from the earth in calcined bodies. All the other partes fire was able to ſeuer. But in theſe, he hath ſo baked the little humidity he hath left in them with their much earth, as he can not diuide them any further. And ſo, though he incorporateth him ſelfe with them, yet he can carry nothing away with him. If then pure water be putt vpon that chalke, the ſubtileſt dry partes of it, do eaſily ioyne to the ſuperuenient moyſture; and ſticking cloſe to it do draw it downe to them; but becauſe they are the lighter, it happeneth to them, as when a man in a boate pulleth the

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land to him: that, cometh not to him; but he remoueth himselfe and his boate to it: so, these ascend in the water as they dissolue. And the water, more and more penetrating them, and by addition of its partes, making the humidity which gleweth their earthy partes together greater and greater; doth make a wider and wider separation betweene those little earthy partes. And so imbueth the whole body of the water with thē; into which, they are dispersed in little atomes. Those that are of biggest bulke, remaine lowest in the water. And in the same measure as their quantities dissolue into lesse and lesse they ascend higher and higher in the water: till att the length, the water is fully replenished with them, and they are diffused through the whole body of it: whiles the more grosse and heauy earthy partes (hauing nothing in them to make a present combination betweene them and the water) do fall downe to the bottome, and settle vnder the water in dust.

In which because earth alone doth predominate in a very great excesse, we can expect no other vertue to be in it, but that which is proper to meere earth: to witt, dryness and weight. Which ordinary Alchymistes looke not after: and therefore call it *Terra damnata*: but others, find a fixing quality in it, by which they performe very admirable operations. Now if you powre the impregnated water from the *Terra damnata*, and then euaporate it; you will find a pure white substance remaining. Which by its bulke, sheweth it selfe to be very earthy; and by its pricking, and corrosiue tast, will informe you much fire is in it, and by its easy dissolution in a moist place, that water had a great share in the production of it. And thus the saltes of bodies are made and extracted.

9. How water mingled with salt, becometh a most powerfull Agent to dissolue other bodies.

Now as water doth dissolue salt, so by the incorporation and vertue of that corrosiue substance it doth more then salt it selfe can doe: for hauing gotten acrimony, and more weight by the mixture and dissolution of salt in it, it maketh it selfe a way into solide bodies, euen into mettals; as we see in brasse and iron; which are easily rusted by salt dissoluing vpon them. And according as the saltes are stronger, so this corrosiue vertue encreaseth in them, euen so much, as neyther syluer nor gold, are free from their eating quality. But they, as well as the rest, are diuided into most small partes, and are made to swimme in water, in such sort as we haue explicated aboue, and whereof euery ordinary Alchymist teacheth the practise.

But this is not all; salts do helpe as well to melt hard bodies and mettalls, as to corrode them: for some fusible salts flowing vpon them by the heate of the fire, and others dissolued by the steame of the mettall that incorporateth with them; as soone as they are in fluxe, they mingle with the naturall iuice of the mettall, and penetrate them deeper, then without them the fire could doe, and swell them and make them fitt to runne.

10. How putrefaction is caused.

These are the principall wayes of the two last instruments in dissoluing

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dissoluing of bodies; taking each of them by it selfe. But there remaineth one more of very great importance, as well in the workes of nature as of art; in which, both the former are ioyned and do concure: and that is putrefraction. Whose way of working is by gentle heate and moisture to wett and pierce the body it worketh vpon; whereby, it is made to swell: and the hoat partes of it, being loosened, they are att length druncke vp and drowned in the moist ones (from whence, by fire they are easily separated as we haue already declared;) and those moist partes, afterwardes leauing it, the substance remaineth dry, and falleth in pieces, for want of the glew that held it together.

THE SIXTEENTH CHAPTER.

An explication of certaine Maximes touching the operations, and qualities of bodies: and whether the Elements be found pure in any part of the world.

OVt of what we haue determined, concerning the naturall actions of bodies, in their making and destroying one an other; it is easy to vnderstand the right meaning of some termes, and the true reason of some maximes much vsed in the schooles. As first; when Philosophers attribute vnto all sortes of corporeall Agents, *a Sphere of Actiuity*. The sense of that manner of expression, in fire appeareth plainely, by what we haue already declared of the nature and manner of operation of that Element.

1. What is the sphere of actiuity in corporeall Agents.

And in like manner, if we consider how the force of cold consisteth in a compression of the body that is made cold, we may preceiue that if in the cooled body there be any subtile partes which can breake forth from the rest, such compression will make them do so. Especially, if the compression be of little partes of the compressed body within themselues, as well as of the outward bulke of the whole body round about: for at first the compression of such causeth in the body, where they are, little holes or pores in the places they are compressed and driuen from; which pores, they filled vp when they were dilated att their owne naturall liberty. But being thus forcibly shrunke vp into lesse roome, afterwardes, they squeese againe out of their croude all such very loose and subtile partes (residing till then with them) as can find their way out from among them. And these subtile partes, that thus are deliuered from the colds compression, gett first into the pores that we haue shewed were made by this compression. But they can not long stay there; for the atomes of aduenient cold that obsesse the compressed body, do likewise with all their force, throng into those pores, and soone driue out the subtile guestes they find there, because they are more in number, bigger in bulke, and more violent in their course then they. Who

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therefore muſt yield vnto them the little channels, and capacities they formerly tooke vp. Out of which they are thruſt with ſuch an impetuoſity, that they ſpinne from them with a vehemence, as quickeſiluer doth through leather, when to purify it, or to bring an Amalgame to a due conſiſtence, it is ſtrained through the ſides of it.

Now theſe shoures or ſtreames of atomes iſſuing from the compreſſed body, are on all ſides round about it att exceeding little diſtances; becauſe the pores, out of which they are driuen, are ſo likewiſe. And conſequently there they remaine round about beſieging it, as though they would returne to their originall homes, as ſoone as the vſurping ſtrãgers that were too powerfull for thẽ, will giue thẽ leaue. And according to the multitude of thẽ, and to the force with which they are driuen out; the compaſſe they take vp round about the cõpreſſed body, is greater or leſſer. Which beſieging atomes are not ſo ſoone carried away by any exterior and accidentall cauſes, but they are ſupplyed by new emanations ſucceeding them out of the ſaid compreſſed body.

Now this which we haue declared by the example of cold cõpreſſing a particular body, happeneth in all bodies whereſoeuer they be in the world: for this being the vnauoydable effect of heate and of cold, whereſoeuer they reſide; (which are the actiue qualities, by whoſe meanes not onely fire and water and the other two Elements; but all other mixed bodies compoſed of the Elements, haue their actiuity) and they being in all bodies whatſoeuer (as we haue proued aboue) it followeth euidently, that there is not a body in the world, but hath about it ſelfe an orbe of emanations of the ſame nature which that body is of. Within the compaſſe of which orbe, when any other body cometh that receiueth an immutation by the little atomes whereof that orbe is compoſed, the aduenient body ſeemeth to be affected and as it were replenished with the qualities of the body from whence they iſſue. Which is then ſaid to worke vpon the body that imbibeth the emanations that flow from it. And becauſe this orbe (regularly ſpeaking) is in the forme of a ſphere, the paſſiue body is ſaid to be within the ſphere of the others actiuity.

2. The reaſon why no body can worke in diſtance.

Secondly; when Philoſophers pronounce, that *No corporeall nature can operari in diſtans;* that is, that no body can worke vpon an other remote from it, without working firſt vpon the body that lyeth betweene them, which muſt continue and piece vp the operation from the Agent to the patient. The reaſon and truth of this maxime is in our Philoſophy euident; for we hauing shewed that action among bodies is performed for the moſt part, by the emiſſion of little partes out of one body into an other: as alſo, that ſuch little partes can not ſtreame from the body that is their fountaine, and ſettle vpon a remote body, without paſſing through the interiacent bodies; which muſt furnish them, as it were, with channels and pipes to conuey them whither they are to goe; It followeth manifeſtly, that the actiue emiſſaries of the working body, can neuer reach their diſtant marke, vnleſſe they be

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ſucceſſiuely ferryed ouer the medium, that lyeth betweene them; in which, they muſt needes leaue impreſſions of their hauing beene there, and ſo worke vpon it in their paſſage, and leaue in it their qualities and complexions; as a payment for their waftage ouer.

3. An obiection anſwered againſt the manner of explicating the former axiome.

But peraduenture ſome may contend, that theſe inuiſible ſerieants and workmen are too feeble and impotent to performe thoſe viſible great effects we dayly ſee. As when fire att the length burneth a board that hath beene a great while oppoſed to it, though it touch not the body of the fire; or when a loadeſtone draweth vnto it a great weight of iron that is diſtant from it.

Vnto whom we ſhall reply, that if he will not grant theſe ſubtile emanations from the agent body, to be the immediate workers of theſe effects; he muſt allott that efficacy vnto the whole corpulency of all the Agent working in bulke (for beſides the whole, and the partes there is no third thing to be conſidered in bodies; ſince they are conſtituted by quantity;) but the whole, can not worke otherwiſe then by locall motion: which in this caſe it can not doe, becauſe by the ſuppoſition, it is determined to keepe its diſtance from the paſſiue body, and not to moue towardes it. Therefore, this is impoſſible; whereas the other can appeare but difficult att the worſt, and therefore muſt be admitted, when no better and more intelligible ſolution can be found.

But withall we muſt note that it is not our intention to ſay, but that it may in ſome circumſtances happen that ſome particular action or effect may be wrought in a remote part or body, which ſhall not be the ſame in the intermediate body that lyeth between the Agent and the patient, and that conueyeth the Agents working atomes to the others body. As for example when tinder or Naphtha is by fire made to burne att a yarde diſtance from it, when the interiacent ayre is but warmed by that fire. Or when the ſunne, by meanes of a burning glaſſe or of ſome other reflexion, ſetteth ſome bodies on fire, and yet onely enlighteneth the glaſſe and the ayre that are in the way. The reaſon of which is manifeſt to be the diuers diſpoſitions of the different ſubiects in regard of the Agent: and therefore it is no wonder that diuers effects ſhould be produced according to thoſe diuers diſpoſitions.

4. Of reaction and firſt in pure locall motion, that each Agēt muſt ſuffer in acting and acte in ſuffering.

A third poſition among Philoſophers is, that all bodies which worke vpon others, do likewiſe at the ſame time, wherein they worke; ſuffer from thoſe they worke vpon: and contrariwiſe that all bodies which ſuffer from others, do att the ſame time worke backe againe vpon them. For the better vnderſtanding whereof, lett vs conſider that all action among bodies is eyther purely locall motion, or elſe locall motion with certaine particularities which giue it a particular name. As when we expreſſe the locall motion of little atomes of fire, or of earth, or water vpon and into other bodies by the wordes of heating or cooling; and ſo of the like. Now if the action be pure locall motion, and conſequently the effect produced by that action be meerely change of

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place; we must call to mind how two dense bodies mouing one against the other, do each of them beare before them some little quantity of a rarer body immediately ioyned vnto them: and consequently, these more rare bodies must be the first to feele the power of the dense bodies and to receiue impressions from their motions; each of them, by the opposite rare body, which like an huissier goeth before to make way for his following master that obligeth him to this seruice.

Now when these rare vshers haue struggled a while like the first lightly armed rankes of two armies in the interiacent field between their maine battalies, that follow them close att the heeles; they must att the length yield, when they are ouerborne by a greater weight then they can sustaine; and then they recoyle backe, as it were to saue themselues by getting in among the files of the dense bodies that droue them on; which not opening to admitt them, and yet they still flying violently from the mastering force that pursueth them; they presse so hard vpon what att the first pressed them on, as notwithstanding their density and strength they force them to retire backe: for vnlesse they do so, they are not of the number of those that worke vpon one an other.

And this retiring, is eyther on both sides, or but of one side. If both; then it is euident how each of them is an Agent, and each of them a sufferer; each of them ouercoming his opposite in such sort, as himselfe likewise receiueth blowes and losse. But if onely one of the dense bodies be so shocked as to recoyle backe, then that onely suffereth in its body, and the other suffereth onely in its vertue; that is, in the ayre or other rare body it sendeth before it; which it driueth with such a violence, that it mastereth and quelleth the opposition of the other body, before it can reach to shake the dense body, before which it runneth. Yet that rare body must be pressed and broken into, in some measure, by the encounter of the other (which though neuer so weake yet maketh some resistance) but much more when it cometh to grapple with the dense body it selfe: and so between them, it is wounded and enfeebled, like those souldiers that first enter a breach in a owne; from whence when they haue driuen the enemy, they pursue him to the cittadell, and force him from thence too: and so how maymed soeuer they proue, they make a free and easy way without resistance for the whole body of their army to follow them, and take quiett possession of that which did cost them so much to winne.

And thus we see how it may happen that one of these mouing bodies doth not suffer so much as to be stayed in its iourney; much lesse, to be driuen backe. And yet the other body att the same time worke in some measure vpon it, by working vpon what is next to it; which recoyling against it must needes make some impression vpon it, since there can be no opposition but must haue some effect. Now this impression or effect, though it be not perceptible by causing a contrary motion, yet it must needes enfeeble the vertue of the conquering Agent,

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Agent, and deaden the celerity of its motion. And thus it is euident, that in all pure locall motions of corporeall Agents, euery one of them must in some proportion suffer in acting, and in suffering must act.

5. The former doctrine applyed to other locall motions designed by particular names. And that Suisseths argument is of no force against this way of doctrine.

And what we haue said of this kind of action, may easily be applyed to the other where the effect of locall motion is designed by a particular name, as it is in the exãples we gaue of heating and cooling. And in that, the proceeding will appeare to be the very same as in this; for if fire doth heate water, the water reacteth againe, eyther vpõ the fire and cooleth it, if it be immediate vnto it; or else vpon the interiacent ayre, if it be att a distance from the fire. And so the ayre is, in some measure cooled, by the cold atomes that issue from the water, whose compasse or sphere of actiuity being lesser then the fires, they can not coole so farre off, as the others can heate: but where they do arriue, they giue their proportion of cold, in the very middest of the others army of fiery atomes, notwithstanding their multitude and violence.

According to which doctrine, our countryman Suisseth his argument, that in the schooles is held insoluble, hath not so much as any semblance of the least difficulty: for it is euident that such atomes of fire and of water as we determine heate and cold to be, may passe and croude by one an other into the subiects they are sent vnto by diuers little streames without hindering one an other (as we haue declared of ayre and light) and each of them be receiued in their owne nature and temper by the same subiect; though sense can iudge onely according to which of them is predominant, and according to the proportion of its superiority.

Vpon which occasion we can not choose but note, how the doctrine of qualities is not onely vnable to giue account of the ordinary and plaine effects of nature; but also vseth to end in cleere impossibilities and contradictions if it be driuen farre: as this argument of Suisseth sheweth, and many others of the like nature.

6. Why some notions do admitt of intension and Remission; and others do not.

A fourth position among Philosophers is, that some notions do admitt the denominations of Intension and Remission, but that others do not. The reason of which we shall cleerely see, if we but consider how these termes of *intension and remission*, do but expresse *more or lesse*, of the thing that is said to be intended or remitted: for the nature of more and lesse, doth imply a latitude and diuisibility; and therefore can not agree with the nature of such thinges as consist in an indiuisible being. As for example to be a *whole*, or to be an *equall*, can not be sometimes more, sometimes lesse; for they consist in such a rigorous indiuisible being, that if the least part imaginable be wanting it is no longer a *whole*, and if there be the least excesse between two thinges, they are no longer equall, but are in some other proportion then of equality in regard of one an other.

And hence it is that Aristotle teacheth vs that *substance* and the species of Quantity, do not admitt of intension and remission; but that Quality doth. For first in *substance*, we know that the signification of this word

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is, that which maketh a thing be what it is, as is euident by our giuing it for an answere to the question what a thing is. And therefore, if there were any diuisibility in substance, it would be in *what* the thing is; and consequently, euery diuision following that diuisibility, would make the thing an other *what*, that is an other thing. And so the substance that is pretended to be changed by intension or remission, would not be diuided, as is supposed, but would cease to be, and an other substance would succeede in the roome of it. Whereby you see that euery mutation in substance, maketh a new thing: and that more and lesse in Quiddity can not be pronounced of the same thing.

Likewise in Quantity, it is cleere that its Species do consist in an indiuisible: for as in numbers, tenne lions (for example) or tenne Elephants are no more in regard of multitude then tenne fleas or tenne moates in the sunne; and if you adde or take any thing from tenne, it is no more tenne, but some other number: so likewise in continued extension, a spanne, an elle, an ounce, or any other measure whatsoeuer, ceaseth to be a spanne and the rest, if you adde to it or diminish from it the least quantity imaginable. And peraduenture, the same is also of figures, as of a sphere, a cube, a circle, a square, &c. though they be in the ranke of Qualities.

But if we consider such qualities as heat, cold, moysture, dryness, softnesse, hardnesse, weight, lightnesse, and the like; we shall find that they may be in any body sometimes more, sometimes lesse, (according as the excesse of any Element or mixture is greater in it, att one time then att an other) and yet the body in which these qualities are intended or remitted, remaine still with the same denomination. As when durt continueth still softe, though sometimes it be lesse softe, other whiles softer; and waxe remaineth figurable, whether it be melted or congealed; and wood is still hoat though it loose or gaine some degree of heate.

But such intension in any subiect whatsoeuer hath its determinate limits that it can not passe; for when more of that quality that we say is intended (that is, more of the atomes of the actiue body) is brought into the body that suffereth the intension, then its complexion can brooke; it resigneth its nature to their violence and becometh a new thing; such an one as they are pleased to make it. As when wood, with extremity of heating (that is, with bringing into it so many atomes of fire, that the fire is stronger in it then its owne nature) is conuerted into fire, smoake, water, and ashes; and nothing remaineth of the nature of wood.

7. That in euery part of our habitable world; all the foure Elemẽts, are found pure in small atomes; but not in any great bulke.

But before we end this chapter, we may remember how in the close of the fourth we remitted a question concerning the existence of the Elements; (that is; whether in any places of the world there were any pure Elements, eyther in bulke or in little partes;) as being not ready to resolue it, till we had declared the manner of working of bodies one vpon an other. Here then will be a fitt place to determine that, out of what we haue discourſed concerning the actions, whereby bodies are made

made and corrupted: for considering the vniuersall action of fire that runneth through all the bodies we haue commerce withall, by reason of the sunnes influence into them and operation vpon them with his light and beames which reacheth farre and neere; and looking vpon the effects which we haue shewed do follow thence: it is manifest, there can not be any great quantity of any body whatsoeuer, in which fire is not intrinsecally mixed. And on the other side, we see that where fire is once mixed, it is very hard to seperate it totally from thence. Againe we see it is impossible that pure fire should be conserued, without being adioyned to some other body; both because of its violent natiuity, still streaming forth with a great impetuosity; as also, because it is so easily ouercome by any obsident body when it is dilated. And therefore we may safely conclude that no simple Element can consist in any great quantity in this course of nature which we liue in and take a suruay of. Neyther doth it appeare to what purpose nature should haue placed any such storehouses of simples, seeing she can make all needefull complexions by the dissolutions of mixed bodies into other mixed bodies sauouring of the nature of the Elements, without needing their purity to beginne vpon.

But on the other side, it is as euident that the Elements must remaine pure in euery compounded body in such extreme small partes as we vse to call atomes: for if they did not, the variety of bodies would be nothing else, but so many degrees of rarity and density, or so many pure homogeneall Elements, and not bodies composed of heterogeneall partes: and consequently, would not be able to shew that variety of partes which we see in bodies, nor could produce the complicated effects which proceede from them. And accordingly we are sure that the least partes which our senses can arriue to discouer haue many varieties in them: euen so much that a whole liuing creature (whose organicall partes must needes be of exceeding different natures) may be so litle, as vnto our eyes to seeme indiuisible; we not distinguishing any difference of partes in it without the helpe of a multiplying glasse: as in the least kind of mites, and in wormes picked out of Childrens handes we dayly experience. So as it is euident that no sensible part can be vnmingled. But then againe, when we call to mind how we haue shewed that the qualities which we find in bodies do result out of the composition, and mixtion of the Elements, we must needes conclude that they must of necessity remaine in their owne essences in the mixed body. And so out of the whole discourse, determine that they are not there in any visible quantity, but in those least atomes, that are too subtile for our senses to discerne. Which position we do not vnderstand so Metaphysically as to say that their substantiall formes remaine actually in the mixed body; but onely, that their accidentall qualities are found in the compound; remitting that other question vnto Metaphysicians (those spirituall Anatomistes) to decide.

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THE SEVENTEENTH CHAPTER.

Of Rarefaction and Condensation the two first motions of particular bodies.

1. The Authors intent in this and the following chapters.

OVr intention in this discourse, concerning the natures and motions of bodies, ayming no further then att the discouery of what is or may be done by corporeall Agents; thereby to determine what is the worke of immateriall and spirituall substances; it can not be expected att our handes that we should deliuer here an entire and complete body of naturall Philosophy. But onely that we should take so much of it in our way, as is needfull to carry vs with truth and euidence to our iourneys end. It belongeth not then to vs to meddle with those sublime contemplations which search into the nature of the vast Vniuerse, and that determine the vnity and limitation of it; and that shew by what stringes, and vpon what pinnes, and wheeles, and hinges, the whole world moueth: and that from thence do ascend vnto an awfull acknowledgment and humble admiration of the primary cause; from whence, and of which, both the being of it, and the beginning of the first motion, and the continuance of all others doth proceed and depend.

Nor in deede would it be to the purpose for anyman to sayle in this Ocean, and to beginne a new voyage of nauigation vpon it: vnlesse he were assured, he had ballast enough in his shippe to make her sinke deepe into the water and to carry her steadily through those vnruly waues; and that he were furnished with skill and prouision sufficient to go through, without eyther loosing his course by steering after a wrong compasse, or being forced backe againe with shorte and obscure relations of discoueries: since others that went out before him, are returned with a large account to such as are able to vnderstand and summe it vp. Which surely our learned countryman, and my best and most honoured frend, and to whom of all men liuing I am most obliged (for to him I owe that litle which I know; and what I haue, and shall sett downe in all this discourse, is but a few sparkes kindled by me att his greate fire) hath both profoundly, and acutely, and in euery regard iudiciously performed in his Dialogues of the world.

Mr. Thomas White.

Our taske then (in a lower straine; and more proportionate to so weake shoulders) is to looke no further then among those bodies we conuerse withall. Of which, hauing declared by what course and engines nature gouerneth their common motions, that are found euen in the Elements, and from thence are deriued to all bodies composed of them; we intend now to consider such motions as accompany diuers particular bodies,

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bodies, and are much admired by whosoeuer vnderstandeth not the causes of them.

To beginne from the easiest and most connexed with the actions of the Elements, the handsell of our labour will light vpon the motions of *Rarefaction and Condensation*, as they are the passions of mixed bodies. And first for Rarefaction; we may remember how it proceedeth originally from fire, and dependeth of heate; as is declared in the former chapter: and whereſoeuer we find Rarefaction, we may be confident the body which suffereth it, is not without fire working vpon it. Fromhence we may gather, that when the ayre imprisoned in a baloone or bladder, swelleth against what cõtaineth it; and stretcheth its case, and seeketh to breake out; this effect must proceed from fire or heate (though we see not the fire) working eyther within the very bowels of the ayre; or without, by pressing vpon what containeth it, and so making it selfe a way vnto it.

1. That bodies may be rarifyed, both by outward and inward heat; and how this is performed.

And that this latter way is able to worke this effect; may be conuinced by the contrary effect from a contrary cause: for take a bladder stretched out vnto its greatest extent by ayre shutt vp within it; and hang it in a cold place; and you will see it presently contract it selfe into a lesse roome; and the bladder will grow wrinckeled and become too bigge for the ayre within it. But for immediate proofe of this position, we see that the addition of a very small degree of heate, rarifyeth the ayre in a weather glasse, (the ayre receiuing the impression of heate, sooner then water) and so maketh it extend it selfe into a greater place; and consequently, it presseth vpon the water; and forceth it downe into a lesse roome then formerly it possessed. And likewise we see quickesyluer and other liquors, if they be shutt vp in glasses close stopped and sett in sufficient heate (and a little is sufficient for this effect) they will swell and fill their glasses; and att the last breake them, rather then not find a way to giue themselues more roome; which is then growne too straight in the glasse, by reason of the rarefaction of the liquors by the fire working vpon them.

Now againe; that this effect may be wrought by the inward heate, that is enclosed in the bowels of the substance thus shutt vp; both reason, and experience do assure vs: for, they teach vs that if a body which is not extremely compacted, but that by its looseneſſe is easily diuisible into little partes (such a one as wine, or other spiritt full liquors) be enclosed in a vessell; the little atomes that perpetually moue vp and downe in euery space of the whole world, making their way through euery body, will sett on worke the little partes, in the wine for example, to play their game: so that the hoat and light partes (if they be many) not enduring to be compressed and kept in by the heauy and cold ones, do seeke to breake out with force; and till they can free themselues from the dense ones that would imprison them they carry them along with them, and make them to swell out as well as themselues.

Now if they be kept in by the vessell, so that they haue not play

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enough; they driue the denſe ones (like ſo many little hammers or wedges) againſt the ſides of it, and att the length do breake it, and ſo do make themſelues way, to a larger roome. But if they haue vent; the more fiery hoat ſpirits fly away, and leaue the other groſſer partes quiett and att reſt. On the other ſide if the hoat and light partes in a liquor be not many nor very actiue, and the veſſell be ſo full that the partes haue not free ſcope to remoue and make way for one an other, there will not follow any great effect in this kind: as we ſee in bottled beere or ale, that worketh little, vnleſſe there be ſome ſpace left empty, in the bottle. And againe; if the veſſell be very much too bigge for the liquor in it, the fiery partes find roome, firſt to ſwell vp the heauy ones; and att the length to gett out from them, though the veſſell be cloſe ſtopped; for they haue ſcope enough to floate vp and downe between the ſurface of the liquor, and the roofe of the veſſell.

And this is the reaſon that if a little beere or ſmall wine be left long in a great caske, be it neuer ſo cloſe ſtopped, it will in time grow dead. And then, if att the opening of the bunge (after the caske hath beene long vnſtirred) you hold a candle cloſe to it, you ſhall att the inſtant ſee a flash of flame enuironing the vent. Which is no other thing, but the ſubtile ſpirits that parting from the beere or wine, haue left it dead; and flying abroad as ſoone as they are permitted, are ſett on fire by the flame that they meete with in their iourney, as being more combuſtible (becauſe more ſubtile) then that ſpiritt of wine which is kept in forme of liquor: and yet that likewiſe (though much groſſer) is ſett on fire by the touch of flame. And this happeneth not onely to wine, and beere, or ale, but euen to water. As dayly experience sheweth in the eaſt Indian shippes, that hauing beene 5. or 6. yeares att ſea, when they open ſome of their caskes of Thames water in their returne homewardes (for they keepe that water till the laſt; as being their beſt and moſt durable; and that groweth lighter and purer, by the often putrifyinges through violent motions in ſtormes, euery one of which maketh new groſſe and earthy partes fall downe to the bottome, and other volatile ones aſcend to the toppe;) a flame is ſeene about their bunges if a candle be neere, as we ſaid before of wine.

And to proceed, with confirming this doctrine by further experience; we dayly ſee that the little partes of heate being agitated and brought into motiō in any body; they enter and pierce into other partes, and incorporate themſelues with them, and ſett them on fire if they be capable thereof: as we ſee in wett hay or flaxe layed together in great quantity. And if they be not capable of taking fire, then they carry them with them to the outſide; and when they can tranſport them no further, part flyeth away, and other part ſtayeth with them: as we ſee in new beere or ale, and in muſt of wine; in which, a ſubſtance vſually called the mother, is wrought vp to the toppe.

Which in wine, will att the laſt be conuerted into Tartar; when the

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ſpirits that are very volatile, are flowne away; and do leaue thoſe partes from whence they haue euaporated, more groſſe and earthy then the others, where the groſſer and ſubtiler partes continue ſtill mixed. But in beere or rather in ale; this mother, which in them we call barme, will continue longer in the ſame conſiſtence, and with the ſame qualities; for the ſpirits of it are not ſo firy that they muſt preſently leaue the body they haue incorporated themſelues withall; nor are hoat enough to bake it into a hard conſiſtence. And therefore, bakers make vſe of it to raiſe their bread; which neyther it will do, vnleſſe it be kept from cold; both which, are euident ſignes that it worketh in force of heate; and conſequently, that it continueth ſtill a hoat and light ſubſtance.

And againe we ſee that after wine or beere hath wrought once, a violent motion will make it worke anew. As is dayly ſeene in great lightninges and in thunder, and by much rocking of them; for ſuch motion rarifyeth, and conſequently heateth them: partly by ſeparating the little partes of the liquor, which were before as glewed together, and therefore lay quietly; but now, by their pulling aſunder, and by the liquors growing thereby more looſe then it was, they haue freedome to play vp and downe: and partly by beating one part againſt an other; which breaketh and diuideth them into leſſer atomes, and ſo bringeth ſome of them into the ſtate of fire; which you may remember, is nothing elſe but a body brought into ſuch a degree of littleneſſe and rarity of its partes.

And this is the reaſon why ſuch hard and dry bodies as haue an vnctuous ſubſtance in them, are by motion eyther eaſily ſett on fire, or att the leaſt, fire is eaſily gotten out of them. As happeneth in flintes, and in diuers other ſtones, which yield fire when they are ſtrucken; and if preſently after you ſmell vnto them, you shall perceiue an odour of brimſtone and of burning which is a certaine ſigne that the motion did conuert into fire the naturall brimſtone that was mingled with the flint, and whoſe denſer partes were growne cold, and ſo ſtucke to the ſtone. And in like manner, the iuywood and diuers others, as alſo the Indian canes (which from thence are called firecanes) being rubbed with ſome other ſticke of the ſame nature; if they be firſt very dry, will of themſelues ſett on fire: and the like will happen to coach wheeles in ſummer if they be ouerheated with motion.

3. Of the great effects of Rarefaction.

To conclude our diſcourſe of rarefaction, we may looke a little into the power and efficacity of it, which is no where to be ſeene ſo clearly as in fire. And as fire is the generall cauſe of rarefaction, ſo is it of all bodies, that which is moſt rarifyed. And therefore it is no maruayle if its effects be the greateſt that are in nature, ſeeing it is the proper operatiõ of the moſt actiue Element. The wonderfull force of it we dayly ſee in thunder, in gunnes, in granados, and in mines; of which, continuall experience, as well as ſeuerall hiſtoryes wittneſſeth litle leſſe then miracles. Leauing them to the remarkes of curious Perſons, we will

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onely looke into the way by which ſo maine effects do proceed from cauſes that appeare ſo ſlender.

It is euident that fire (as we haue ſaid before) dilateth it ſelfe ſpherically; as nature sheweth vs manifeſtly in bubbles of boyling water, and of mike, and generally of ſuch ſubſtances as are of a viſcous compoſition; for thoſe bubbles being round, do aſſure vs that the cauſe which made them, did equally dilate them from the center vnto all partes. Now then remembring the infinite multiplication which is in fire, we may conceiue that when a graine of gunnepouder is turned thereinto, there are ſo many little bubbles of a viſcous ſubſtance one backing an other with great celerity, as there are partes of fire more then there were of gunnepouder. And if we make a computation of the number and of the celerity of theſe bubbles; we shall find that although euery one of them ſingle do ſeeme to be of an inconſiderable force, yet the whole number of them together, will exceed the reſiſtance of the body moued or broken by them: eſpecially, if we note, that when hard ſubſtances haue not time allowed them to yield, they break the ſooner. And then we shall not ſo much admire the extremities we ſee acted by theſe meanes.

4. The firſt manner of condenſation, by heate.

Thus hauing looked into the nature of rarefaction, and traced the progreſſe of it from the motion of the ſunne and fire; in the next place we are to examine the nature of condenſation. And we shall oftentimes find it likewiſe an effect of the ſame cauſe otherwiſe working: for there being two different wayes to dry any wett thing; the one, by taking away that iuice which maketh a body liquid; the other, by putting more drought to the wett body, that it may imbibe the moiſture; this latter way doth as well as the former, condenſe a body: for by the cloſe ſticking of wett to dry, the moſt part of condenſation is effected in compounded bodies.

The firſt of theſe wayes, doth properly and immediately proceed from heate; for heate entering into a body, incorporateth it ſelfe with the moiſt and viſcous partes it findeth there: as purging medicines do with the humors they worke vpon; which when the ſtomacke can no longer entertaine (by reaſon of their vnruly motions in wreſtling together) they are both ejected grappling with one an other; and the place of their contention is thus, by the ſuperuenience of a gueſt of a contrary nature (that will not ſtay long there) purged from the ſuperaboundance of the former ones that annoyed it. Euen ſo the fire that is greedily drunke vp by the watry and viſcous partes of a compounded body; and whoſe actiuity and reſtleſſe nature will not endure to be long empriſoned there, quickly pierceth quite through the body it entereth into, and after a while ſtreameth out att the oppoſite ſide, as faſt as it entered on the ſide next to it, and carryeth away with it thoſe glewy partes it is incorporated with: and by their abſence, leaueth the body they part from, dryer then att the firſt it was.

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Which courſe we may obſerue in ſirupes that are boyled to a conſiſtence, and in brothes that are conſumed vnto a gelly: ouer which, whiles they are making by the fire vnder them, you ſee a great ſteame; which is, the watry partes that being incorporated with fire, fly away in ſmoake. Likewiſe when the ſea water is condenſed into ſalt, you ſee it is an effect of the ſunne or fire that exhaleth or boyleth away all the palpable moiſture. And ſo when wett clothes are hanged eyther in the ſunne or att the fire, we ſee a ſmoake about the clothes, and heate within them; which being all drawne out from them, they become dry.

And this deſerueth a particular note, that although they should be not quite dry, when you take them from the fire; yet by then they are coole, they will be dry: for the fire that is in them when they are remoued from the maine ſtocke of fire, flying away carryeth with it the moiſture that was incorporated with it: and therefore whiles they were hoat, that is, whiles the fire was in them, they muſt alſo be moiſt; becauſe the fire and the moiſture were growne to be one body: and could not become through dry with that meaſure of fire, (for more would haue dryed them, euen whiles they were hoat) vntill they were alſo growne through cold. And in like manner, ſirupes, hydromels, gellies, and the like, grow much thicker after they are taken off from the fire, then they were vpon the fire, and much of their humidity, flyeth away with the fire, in their cooling, whereby they leſſen much of their quantity, euen after the outward fire hath ceaſed from working vpon them.

Now if the moiſt partes, that remaine after the drying, be by the heate well incorporated in the dry partes; and ſo do occaſion the dry partes to ſticke cloſe together; then that body is condenſed, and will (to the proportion of it) be heauyer in a leſſe bulke; as we ſee that mettalls are heauyer then ſtones.

5. The ſecond manner of condenſation by cold.

Although this effect be in theſe examples wrought by heate, yet generally ſpeaking it is more proper to cold: which is the ſecond way of drying a moiſt body. As when in Greeneland, the extreme cold freeſeth the whalefishers beere into yce, ſo that the ſtewardes diuide it with axes and wedges, and deliuer their portions of drinke to their shippes company, and their shallopes gings, in their bare handes: but in the innermoſt part of the butte, they find ſome quantity of very ſtrong liquor, not inferior to moderate ſpiritt of wine. Att the firſt, before cuſtome had made it familiar vnto them, they wondered that euery time they drew att the tappe, when firſt it came from their shippes to the shore (for the heate of the hold would not lett it freeſe) no liquor would come, vnleſſe they new tapped it with a longer gimlett: but they thought that paines well recompenced, by finding it in the taſt to grow ſtronger and ſtronger; till att the laſt, their longeſt gimlets would bring nothing out; and yet the veſſell not a quarter drawne off; which obliged them then to ſtaue the caske, that ſo they might make vſe of the ſubſtance that remained.

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The reaſon of this, is euident : that cold ſeeking to condenſe the beere by mingling its dry and cold partes with it, thoſe that would endure this mixture, were imbibed and ſhrunke vp by them. But the other rare and hoat partes that were ſqueeſed out by the denſe ones which entered to congeale the beere, and were forced into the middle of the veſſell (which was the furtheſt part for them to retire vnto, from their enuironing enemies) did conſerue themſelues in their liquid forme, in defyance of the aſſaulting cold; whiles their fellowes, remaining by their departure more groſſe and earthy then they were before, yielded to the conqueror, they could not ſhift away from, and ſo were dryed and condenſed into yce: which when the mariners thawed, they found it like faire water, without any ſpirits in it or comforting heate to the ſtomacke.

This māner of condenſation, which we haue deſcribed in the freeſing of beere, is the way moſt practiſed by nature; I meane, for immediate condenſation (for cōdentſation is ſecondarily, whereſoeuer there is rarefaction which we haue determined to be an effect of heate.) And the courſe of it is: that a multitude of earthy and dry bodies being driuen againſt any liquor, they eaſily diuide it, by meanes of their denſity, their dryneſſe, and their littleneſſe (all which in this caſe do accompany one an other; and are by vs determined to be powerfull diuiders;) and when they are gotten into it, they partly ſucke into their owne pores the wett and diffuſed partes of the liquide body; and partly they make them (when themſelues are full) ſticke faſt to their dry ſides, and become as a glew to hold themſelues ſtrongly together. And thus they dry vp the liquor; and by the naturall preſſing of grauity they contract it into a leſſer roome. No otherwiſe then when we force much wind or water into a bottle; and by preſſing it more and more, make it lye cloſer then of its owne nature it would do. Or rather, as when aſhes being mingled with water; both thoſe ſubſtances do ſticke ſo cloſe to one an other, that they take vp leſſe roome then they did each apart.

This is the methode of froſtes, and of ſnow, and of yce, both naturall and artificcall; for in naturall freeſing, ordinarily the north or northeaſt wind by its force bringeth and driueth into our liquors, ſuch earthy bodies as it hath gathered from rockes couered with ſnow; which being mixed with the light vapors whereof the wind is made, do eaſily find way into the liquors, and thē they dry thē into that conſiſtēce which we call yce. Which in token of the wind it hath in it, ſwimmeth vpon the water, and in the veſſel where it is made, riſeth higher then the water did whereof it is cōpoſed: and ordinarily it breaketh frō the ſides of the veſſell ſo giuing way to more wind to come in, and freeſe deeper and thicker.

6. That yce is not water rarifyed but condenſed.

But becauſe Galileus *Nel diſcorſo intorno alle coſe che ſtanno in ſu l'acqua pag.* 4. was of opinion that yce was water rarifyed, and not condenſed; we muſt not paſſe ouer this verity, without maintaining it againſt the oppoſition of ſo powerfull an aduerſary. His arguments are;

firſt

firſt that yce taketh vp more place, then the water did of which it was made; which is againſt the nature of condenſation. Secondly, that quantity for quantity, yce is lighter then water; whereas thinges that are more denſe, are proportionally more heauy. And laſtly, that yce ſwimmeth in water, whereas we haue often taught, that the more denſe deſcendeth in the more rare.

Now to reply to theſe arguments, we ſay firſt, that we would gladly know how he did to meaſure the quantity of the yce, with the quantity of the water of which it was made; and then when he hath shewed it, and shewed withall that yce holdeth more place then water; we muſt tell him that his experiment concludeth nothing againſt our doctrine, becauſe there is an addition of other bodies mingled with the water to make yce of it as we touched aboue; and therefore that compound may well take vp a greater place then the water alone did, and yet be denſer then it; and the water alſo be denſer, then it was.

And that other bodies do come into the water and are mingled with it, is euident, out of the exceeding coldneſſe of the ayre, or ſome very cold wind; one of which two neuer miſſeth to raigne whenſoeuer the water freeſeth: and both of them do argue great ſtore of little earthy dry bodies abounding in them, which ſweeping ouer all thoſe that lye in their way and courſe, muſt of neceſſity be mixed with ſuch as giue them admittance; which water doth very eaſily. And accordingly we ſee that when in the freeſing of water, the yce groweth any thing deepe, it eyther ſhrinketh about the borders or att the leaſt lyeth very looſe; ſo as we can not doubt but that there is a free paſſage for more of ſuch ſubtile bodies to gett ſtill to the water, and freeſe it deeper.

To his ſecond argument, we aske how he knoweth that yce quantity for quantity, is lighter then water? For although, of a ſpunge that is full of water, it be eaſy to know what the ſpunge weigheth, and what the water, that was ſoaked into it, becauſe we can part the one of them from the other, and keepe each apart, to examine their weights: yet to do the like between yce and water, if yce be throughout full of ayre (as of neceſſity it muſt be) we beleeue impoſſible. And therefore, it may be lighter in the bulke then water, by reaſon of the great pores cauſed in it, through the ſhrinking vp of the partes of water together (which pores muſt then neceſſarily be filled with ayre) and yet euery part by it ſelfe (in which no ayre is) be heauyer then ſo much water.

And by this it appeareth that his laſt argument, (grounded vpon the ſwimming of yce in water) hath no more force then if he would proue that an iron or an earthen dish, were lighter, and conſequently more rare, then water; becauſe it ſwimmeth vpon it; which is an effect of the ayres being contained in the belly of it (as it is in yce) not a ſigne of the mettalls being more rare then water.

Whereas on the contrary ſide, the proofe is poſitiue and cleare for vs; for it can not be denyed, but that the mingling of the water with other

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bodies more denſe then it, muſt of neceſſity make the compound and alſo the water it ſelfe become more denſe then it was alone. And accordingly we ſee, that yce halfe thawed (for then, much of the ayre is driuen out, and the water beginneth to fill the pores wherein the ayre reſided before) ſinketh to the bottome: as an iron dish with holes in it (whereby the water might gett into it) would do. And beſides, we ſee that water is more diaphanous then yce, and yce more conſiſtent then water. Therefore I hope we shall be excuſed, if in this particular we be of a contrary opinion to this great perſonage.

7. How wind, ſnow, and haile are made; and wind by raine allayed.

But to returne vnto the thridde of our diſcourſe. The ſame that paſſeth here before vs; paſſeth alſo in the skye with ſnow, haile, raine, and wind. Which that we may the better vnderſtand, lett vs conſider how windes are made: for they haue a maine influence into all the reſt. When the ſunne by ſome particular occurrent, rayſeth great multitudes of atomes, from ſome one place; and they eyther by the attraction of the ſunne, or by ſome other occaſion, do take their courſe a certaine way; this motion of thoſe atomes we call a wind: which according to the continuance of the matter from whence theſe atomes riſe, endureth a longer or a shorter time, and goeth a farther or a shorter way; like a riuer, or rather, like thoſe eruptions of waters, which in the Notherne partes of England they call *Gypſies*: the which do breake out att vncertaine times, and vpon vncertaine cauſes, and flow likewiſe with an vncertaine duration. So theſe windes, being compoſed of bodies in a determinate proportion heauyer then the ayre, do runne their courſe from their hight to the ground, where they are ſupported (as water is by the floore of its channell) whiles they performe their carrire; that is, vntill they be waſted, eyther by the drawing of the ſunne, or by their ſticking and incorporating into groſſer bodies.

Some of theſe windes according to the complexion of the body out of which they are extracted, are dry; as thoſe which come from barren mountaines couered with ſnow: others are moiſt; as thoſe that come out of marishy, or watry places: others, haue other qualities; as of heate or cold, of wholeſomeneſſe, or vnwholeſomeneſſe, and the like; partly from the ſource, and partly frō the bodies they are mingled with in their way.

Such then being the nature and origine of windes; if a cold one do meete in the ayre with that moiſt body whereof otherwiſe raine would haue been made, it changeth that moiſt body into ſnow or into haile; if a dry wind meete with a wett body it maketh it more dry, and ſo hindereth the raine that was likely to be: but if the wett body ouercome the dry wind, it bringeth the wind downe along with it; as we ſee when a shoure of raine allayeth a great wind.

And that all this is ſo, experience will in ſome particulars inſtruct vs as well as reaſon, from whence the reſt may be euidently inferred. For we ſee that thoſe who in imitation of nature would conuert water into yce, do take ſnow or yce, and mingle it with ſome actiue dry body, that may force

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force the cold partes of the snow from it; and then they sett the water (in some fitt vessell) in the way that those little bodies are to take, which by that meanes entering into it, do straight incorporate themselues therewith, and of a soddaine do conuert it into yce. Which processe you may easily trye, by mingling salt armoniake with the snow; but much more powerfully, by setting the snow ouer the fire, whiles the glasse of water to be congealed standeth in it after the manner of an egg in salt. And thus, fire it selfe, though it be the enemy and destroyer of all cold, is made the instrument of freesing. And the same reason holdeth, in the cooling of wine with snow or yce, when after it hath beene a competent time in the snow, they whose charge it is, do vse to giue the vessell that containeth the wine, three or foure turnes in the snow; so to mingle through the whole body of the wine, the cold receiued first but in the outward partes of it, and by pressing, to make that without, haue a more forcible ingression.

But the whole doctrine of Meteores, is so amply, so ingeniously, and so exactely performed by that neuer enough praysed Gentleman Monsieur Des Cartes in his Meteorologicall discourses; as I should wrong my selfe, and my Reader, if I dwelled any longer vpon this subiect. And whose Physicall discourses, had they beene diuulged before I had entered vpon this worke, I am persuaded would haue excused the greatest part of my paines in deliuering the nature of bodies.

8. How partes of the same or diuers bodies, are ioyned more strongly together by condensation.

It were a fault to passe from treating of condensation, without noting so ordinary an effect of it as is the ioyning together of partes of the same body, or of diuers bodies. In which we see for the most part that the solide bodies which are to be ioyned together, are first eyther heated or moistened, that is, they are rarifyed: and then they are left to cold ayre, or to other cold bodies, to thicken and condense (as aboue, we mentioned of syrupes and gellies;) and so they are brought to sticke firmely together. In the like manner we see that when two mettalls are heated till they be almost brought to runninge, and then are pressed together by the hammer, they become one continued body. The like we see in glasse, the like in waxe, and in diuers other thinges. On the contrary side; when a broken stone is to be pieced together, the pieces of it must be wetted, and the ciment must be likewise moistened, and then ioyning them aptly, and drying them, they sticke fast together. Glew is moistened, that it may by drying afterwardes, hold pieces of wood together. And the spectaclemakers haue a composition which must be both heated and moistened, to ioyne vnto handles of wood the glasses which they are to grinde. And broken glasses are cimented with cheese and chalke or with garlike.

All these effects our sense euidently sheweth vs, arise out of condẽsation; but to our reasõ it belõgeth to examine particularly by what steppes they are performed Frst then we know that heate doth subtilise the little bodies which are in the pores of the heated body; and partly

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alſo, it openeth the pores of the body it ſelfe, if it be of a nature that permitteth it; as it ſeemeth thoſe bodies are, which by heate are mollifyed or are liquefactible. Againe, we know that moyſture is more ſubtile to enter into ſmall creekes, then dry bodies are; eſpecially when it is preſſed; for then it will be diuided into very little partes, and will fill vp euery little chinke; and neuertheleſſe if it be of a groſſe and viſcous nature, all the partes of it will ſticke together. Out of theſe two properties we haue, that ſince euery body hath a kind of orbe of its owne exhalations, or vapors round about it ſelfe (as is before declared,) the vapors which are about one of the bodies, will more ſtrongly and ſolidely (that is in more aboundant and greater partes) enter into the pores of the other body againſt which it is preſſed, when they are opened and dilated: and thus they becoming common to both bodies, by flowing from the one, and ſtreaming into the other, and ſticking to them both will make them ſticke to one an other. And then as they grow cold and dry, theſe litle partes shrinke on both ſides; and by their shrinking draw the bodies together; and withall, do leaue greater pores by their being compreſſed together, then were there, when by heate and moyſture they were dilated; into which pores the circumſtant cold partes do enter, and thereby do as it were wedge in the others; and conſequently, do make them hold firmely together the bodies, which they ioyne.

But if art or nature should apply to this iuncture any liquor or vapour, which had the nature and power to inſinuate it ſelfe more efficaciouſly to one of theſe bodies, then the glew which was between them did; of neceſſity, in this caſe, theſe bodies muſt fall in pieces. And ſo it happeneth in the ſeparation of mettalls by corroſiue waters; as alſo in the precipitation of mettalls or of ſaltes when they are diſſolued in ſuch corroſiue waters, by meanes of other mettalls or ſaltes of a different nature: in both which caſes the enterance of a latter body that penetrateth more ſtrongly, and vniteth it ſelfe to one of the ioyned bodies but not to the other, teareth them aſunder, and that which the piercing body reiecteth, falleth into little pieces; and if formerly it were ioyned with the liquor, it is then precipitated downe from it in a duſt.

9. Vacuites can not be the reaſon, why water impregnated to the full with one kind of ſalt, will notwithſtãding receiue more of an other.

Out of which diſcourſe we may reſolue the queſtion of that learned and ingenious man Petrus Gaſſendus; who, by experience found, that water impregnated to fullneſſe with ordinary ſalt, would yet receiue a quantity of other ſalt; and when it would imbibe no more of that, would neuertheleſſe take into it a proportion of a third; and ſo of ſeuerall kindes of ſaltes one after an other: which effect, he attributed to vacuites or porous ſpaces of diuers figures, that he conceiued to be in the water; whereof, ſome were fitt for the figure of one ſalt, and ſome, for the figure of an other. Very ingeniouſly; yet if I miſſe not my marke, moſt aſſuredly he hath miſſed his.

For firſt, how could he attribute diuers ſortes of vacuites to water, without

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without giuing it diuers figures? And this would be againſt his owne diſcourſe, by which, euery body should haue one determinate naturall figure.

Secondly; I would aske him, if he meaſured his water after euery ſalting? And if he did, whether he did not find the quantity greater, then before that ſalt was diſſolued in it? Which if he did (as without doubt he muſt) then he might ſafely conclude, that his ſaltes were not receiued in vacuities; but that the very ſubſtance of the water gaue them place, and ſo encreaſed by the receiuing of them.

Thirdly, ſeeing that in his doctrine, euery ſubſtance hath a particular figure; we muſt allow a ſtrange multitude of different shapes of vacuities to be naturally in water; if we will haue euery different ſubſtance wherewith it may be impregnated (by making decoctions, extractions, ſolutions, and the like) to find a fitt vacuity in the water to lodge it ſelfe in. What a difforme nette with a ſtrãge variety of mashes would this be? And indeed how extremely. vncapable muſt it be of the quantity of euery various kind of vacuity that you will find muſt be in it; if in euery ſolution of one particular ſubſtance, you calculate the proportion between it and the water that diſſolueth it, and then multiply it according to the number of ſeuerall kindes of ſubſtances that may be diſſolued in water? By this proceeding, you will find the vacuities to exceed infinitely the whole body of the water; euen ſo much that it could not afford ſubtile thriddes enough to hold it ſelfe together.

Fourthly, if this doctrine were true it would neuer happen that one body or ſalt should precipitate downe to the bottome of the water, by the ſolution of an other in it, which euery Alchymiſt knoweth, neuer fayleth in due circumſtances: for ſeeing that the body which precipitateth, and the other which remayneth diſſolued in the water, are of different figures, and therefore do require different vacuities, they might both of them haue kept their places in the water, without thruſting one an other out of it.

Laſtly, this doctrine giueth no account why one part of ſalt is ſeparated from an other by being putt in the water, and why the partes are there kept ſo ſeparated, which is the whole effect of that motion which we call diſſolution.

10. The true reaſon of the former effect.

The true reaſon therefore of this effect, is (as I conceiue) that one ſalt maketh the water apt to receiue an other; for the lighter ſalt being incorporated with the water, maketh the water more proper to ſticke vnto an heauyer, and by diuiding the ſmall partes of it to beare them vp, that otherwiſe would haue ſunke in it. The truth and reaſon of which will appeare more plaine, if att euery ioynt, we obſerue the particular ſteppes of euery ſaltes ſolution. As ſoone as you putt the firſt ſalt into the water, it falleth downe preſently to the bottome of it; and as the water doth by its humidity pierce by degrees the little ioyntes of this ſalt, ſo the ſmall partes of it are by little and little ſeparated from one an other, and

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vnited to partes of water. And ſo infuſing more and more ſalt, this progreſſe will continue, vntill euery part of water is incorporated with ſome part of ſalt: and then, the water can no longer worke of it ſelfe but in coniunction to the ſalt with which it is vnited. After which, if more ſalt of the ſame kind be putt into the water; that water ſo impregnated, will not be able to diuide it; becauſe it hath not any ſo ſubtile partes left, as are able to enter between the ioyntes of a ſalt ſo cloſely compacted: but may be compared to that ſalt, as a thing of equall dryneſſe with it; and therefore is vnapt to moyſten and to pierce it.

But if you putt vnto this compound of ſalt and water, an other kind of ſalt that is of a ſtronger and a dryer nature then the former, and whoſe partes are more groſſely vnited; then the firſt ſalt diſſolued in the water, will be able to gett in betwixt the ioyntes of the groſſer ſalt, and will diuide it into little partes; and will incorporate his already compoſed partes of ſalt and water, into a decompound of two ſaltes and water; vntill all his partes be anew impregnated with the ſecond groſſer ſalt; as before, the pure water was with the firſt ſubtiler ſalt. And ſo it will proceed on, if proportionate bodies be ioyned, vntill the diſſoluing compoſition do grow into a thicke body.

Vnto which diſcourſe we may adde, that when the water is ſo fully impregnated with the firſt ſalt, as it will receiue no more, remayning in the temper it is in; yet if it be heated, it will then afresh diſſolue more of the ſame kind. Which sheweth, that the reaſon of its giuing ouer to diſſolue, is for want of hauing the water diuided into partes little enough to ſticke vnto more ſalt: which, as in this caſe the fire doth; ſo peraduenture in the other, the acrimoniouſneſſe of the ſalt doth it.

II. The reaſon why bodies of the ſame nature do ioyne more eaſily together then others.

And this is ſufficient to giue curious wittes occaſion by making further experiments, to ſearch out the truth of this matter. Onely we may note what happeneth in moſt of the experiencies we haue mentioned; to witt that thinges of the ſame nature do ioyne better and more eaſily then others that are more eſtranged from one an other. Which is very agreeable to reaſon; ſeeing that if nature do intend to haue thinges conſiſt long together, she muſt fitt them for ſuch conſiſtence.

Which ſeemeth to proceed out of their agreement in foure qualities: firſt, in weight for bobies of diuers degrees in weight, if they be att liberty, do ſeeke diuers places; and conſequently, ſubſtances of like weight, muſt of neceſſity find one an other out, and croud together; as we haue shewed, it is the natute of heate to make them do: now it is apparent that thinges of one nature, muſt in equall partes haue the ſame or a neere proportion of weight, ſeeing that in their compoſition, they muſt haue the ſame proportion of Elements.

The ſecond reaſon of the conſiſtence of bodies together, that are of the ſame nature is, the agreement of their liquid partes, in the ſame degree of rarity and denſity: for as it is the nature of quantity in common to

make

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make all partes be one quantity; ſo it is the nature of the degrees of quantity, when two partes do meete that are of the ſame degree, to make them one in that degree of quantity; which is, to make them ſtick together in that degree of ſticking, which the degree of denſity that is common to them both, maketh of its owne nature. Whereas, partes of different denſities, can not haue this reaſon of ſticking: though, peraduenture they may vpon ſome other ground, haue ſome more efficacious one. And in this manner, the like humide partes of two bodies, becoming one, the holes or receptacles in which thoſe humide partes are contained muſt alſo needes be vnited.

The third reaſon is the agreeable proportion, which their ſeuerall figures haue in reſpect of one an other: for if any humidity be extracted out of a mixed body, eſpecially, by the vertue of fire; it muſt haue left pores of ſuch figures, as the humidity that is drawne out of them, is apt to be cutt into (for euery humide body not being abſolutely humide, but hauing certaine dry partes mixed with it, is more apt for one kind of figure and greatneſſe, then for an other;) and by conſequence, whenſoeuer that humidity shall meete againe with the body it was ſeuered from; it will eaſily runne through and into it all, and will fill exactly the cauities and pores it poſſeſſed before.

The laſt quality, in which bodies that are to conſiſt long together, do agree, is the biggneſſe of the humide and dry partes of the ſame body: for if the humide partes be too bigge for the dry ones, it is cleare that the dry ones muſt needes hang looſely together by them; becauſe their glew is in too greate a quantity. But if the humide partes bee too little for the dry ones, then of neceſſity ſome portion of euery little dry part muſt be vnfurnished of glew, by meanes whereof to ſticke vnto his fellow: and ſo the ſticking partes not being conueniently proportioned to one an other, their adheſion can not be ſo ſolide as if each of them were exactly fitted to his fellow.

THE EIGHTEENTH CHAPTER.

Of an other motion belonging to particular bodies, called Attraction; and of certaine operations, termed Magicall.

HAuing thus ended the two motions of rarefaction and of condenſation; the next that offer themſelues, are the locall motions which ſome bodies haue vnto others. Theſe are ſometimes performed by a plaine force in the body towardes which the motion is: and other whiles, by a hidden cauſe, which is not ſo eaſily diſcerned. The firſt, is chiefely that which is ordinarily ſaid to be done by the force of nature to hinder *Vacuum*, and is much practiſed by nature; as in drawing our breath, in ſucking, and in many other naturall

1. What Attraction is, and from whence it proceedeth.

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operations, which are imitated by art in making of pumpes, syphons, and such other instruments; and in that admirable experiment of taking vp a heauy marble stone meerely by an other lying flatt and smoothly vpon it, without any other connexion of the two stones together; as also by that sport of boyes, when they spread a thinne moystned leather vpon a smooth broad stone, and presse it all ouer close to it, and then by pulling of a string fastened att the middle of the leather, they draw vp likewise the heauy stone. In all which, the first cause of the motion, proceedeth from that body towardes which the motion is made. And therefore, is properly called *Attraction*.

For the better vnderstanding and declaring of which, lett vs suppose two marble stones, very broad and exceeding smoothly polished, to be laid one flatt vpon the other: and lett there be a ring fastened att the backe part of the vppermost stone; and exactly in the middle of it. Then, by that ring, pull it vp perpendicularly and steadily, and the vndermost will follow sticking fast to the ouermost; and though they were not very perfectly polished, yet the nethermost would follow for awhile, if the ring be suddainely plucked vp; but then it will soone fall downe againe. Now this plainely sheweth that the cause of their sticking so strongly together, when both the stones are very well polished, is for that nothing can well enter between them to part them; and so, it is reduced to the shortnesse of the ayre that is betwixt them: which not being capable of so great an expansion, nor admitting to be diuided thickewayes so much as is necessary to fill the first growing distance, between the two stones till new ayre findeth a course thither, (that so, the swelling of the one, may hinder vacuity, till the other come in to the rescue;) the two stones must needes sticke together to certaine limits; which limits will depend of the proportion that is between the weight, and the continuity of the nethermost stone.

2. The true sense of the Maxime, that *Nature abhorreth from vacuity*.

And when we haue examined this, we shall vnderstand in what sense it is meaned that *Nature abhorreth from Vacuity*; and what meanes she vseth to auoyde it. For, to putt it as an enemy that nature fighteth against; or to discourse of effects that would follow from it, in case it were admitted, is a great mistake, and a lost labour; seeing it is nothing; and therefore, can do nothing: but is meerely a forme of expression to declare in short nothing else but that it is a contradiction, or implication in termes, and an impossibility in nature, for vacuity to haue, or to be supposed to haue a *Being*.

Thus then, since in our case, after we haue cast all about, we can pitch vpon nothing to be considered, but that the two stones do touch one an other, and that they are weighty; we must apply our selues onely to reflect vpon the effects proceeding from these two causes, their contiguity and their heauynesse; and we shall find that as the one of them, namely the weight hindereth the vndermost from following the vppermost, so, contiguity obligeth it vnto that course; and according as the one

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the one ouercometh the other, ſo will this action be continued or interrupted.

Now that contiguity of ſubſtances do make one follow an other, is euident by what our Maſters in Metaphyſickes teach vs; when they shew that without this effect no motion att all could be made in the world, nor no reaſon could be giuen, for thoſe motions we dayly ſee. For ſince the nature of quantity is ſuch, that whenſoeuer there is nothing between two partes of it, they muſt needes touch and adhere and ioyne to one an other, (for how should they be kept aſunder when there is nothing betweene them to part them?) if you pull one part away, eyther ſome new ſubſtance muſt come to de cloſe vnto that which remoueth; or elſe the other which was formerly cloſe to it, muſt ſtill be cloſe to it, and ſo follow it: for if nothing do come between, it is ſtill cloſe to it. Thus then, it being neceſſary that ſomething muſt be ioyned cloſe to euery thing, vacuity, (which is nothing) is excluded from hauing any being in nature.

And when we ſay that one body muſt follow an other to auoyde vacuity; the meaning is, that vnder the neceſſity of a contradiction they muſt follow one an other, and that they can not do otherwiſe. For it would be a contradiction to ſay that nothing were between two thinges and yet that they are not ioyned cloſe to one an other. And therefore if you should ſay it, you would in other wordes ſay, they are cloſe together, and they are not cloſe together. In like manner, to ſay that vacuity is any where, is a pure contradiction; for vacuity being nothing, hath no *Being* att all: and yet by thoſe wordes it is ſaid to be in ſuch a place; ſo that they affirme it *to be* and *not to be*, att the ſame time.

But now lett vs examine if there be no meanes to auoyde this contradiction and vacuity, other then by the adheſion, and following of one body vpon the motion of an other, that is cloſely ioyned to it and euery where contiguous. For ſenſe is not eaſily quieted with ſuch Metaphyſicall contemplations, that ſeeme to repugne againſt her dictamens; and therefore for her ſatisfaction we can do no leſſe then giue her leaue to range about, and caſt all wayes in hope of finding ſome one that may better content her: which when she findeth that she can not, she will the leſſe repine to yield her aſſent to the rigourous ſequeles and proofes of reaſon. 3. The true reaſō of attraction.

In this difficulty then, after turning on euery ſide, I for my part can diſcerne no pretence of probability, in any other meanes then in pulling downe the lower ſtone by one corner; that ſo there may be a gaping between the two ſtones, to lett in ayre by little and little. And in this caſe you may ſay that by the interuention of ayre, vacuity is hindered, aud yett the lower ſtone is left att liberty to follow its owne naturall inclination, and be gouerned by its weight. But indeed, if you conſider the matter well; you will find that the doing this, requireth a much greater force, then to haue the lower ſtone follow the vpper: for it can

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not gape in a ſtraight line, to lett in ayre; ſince in that poſition, it muſt open at the bottome where the angle is made, at the ſame time that it openeth at the mouth: and then ayre requiring time to paſſe from the edges to the bottome, it muſt in the meane while fall into the contradiction of vacuity. So that if it should open to lett in ayre; the ſtone, to compaſſe that effect, muſt bend, in ſuch ſort as wood doth when a wedge is putt into it to cleaue it.

Iudge then what force it muſt be that should make hard marble of a great thickneſſe bend like a wand; and whether it would not rather breake and ſlide off, then do ſo: you will allow that a much leſſe, will raiſe vp the lower ſtone together with the vppermoſt. It muſt then of neceſſity fall out, that it will follow it, if it be moued perpendicularly vpwardes. And the like effect will be though, it should be rayſed at oblique angles, ſo that the lowermoſt edge do reſt all the way vpon ſome thing that may hinder the inferior ſtone from ſliding aſide from the vppermoſt.

4. water may be brought by the force of attraction to what height ſoeuer,

And this is the very caſe of all thoſe other experiments of art and nature, which we haue mentioned aboue: for the reaſon holdeth as well in water and in liquide thinges; as in ſolide bodies; vntill the weight of the liquide body ouercometh the continuity of it: for then, the thridde breaketh, and it will aſcend no higher.

Which height, Galileo telleth vs from the workmen in the Arſenall of Venice, is neere 40. foote; if the water be drawne vp in a cloſe pipe, in which the aduantage of the ſides helpeth the aſcent. But others ſay that the inuention is enlarged, and that water may be drawne to what height one pleaſeth. Howſoeuer, the force which nature applyeth to maintaine the continuity of quantity, can haue no limitt, ſeeing it is grounded vpon contradiction. And therefore Galileo was much miſtaken, when he throught to make an inſtrument whereby to diſcouer the limits of this force.

We may then conclude that the breaking of the water muſt depend from the ſtrength of other cauſes. As for example when the grauity is ſo great by encreaſing the bulke of the water, that it will eyther ouercome the ſtrength of the pipe, or elſe make the ſucker of the pumpe rather yield way to ayre, then draw vp ſo great a weight: for which defects, if remedies be found, the art may ſurely be enlarged without end.

5. The doctrine touching the attraction of water in ſyphons.

This is particular in a ſyphon; that when, that arme of it which hangeth out of the water is lower then the ſuperficies of the water; then, it will runne of it ſelfe; after it is once ſett on running by ſucking. The reaſon whereof is, becauſe the weight which is in the water pendant, is greater then the weight of the aſcending water; and thereby ſupplyeth the want of a continuall ſucker. But if the noſe of that arme that hangeth out of the water, be but euen with the water; then the water will ſtand ſtill in both pipes, or armes of the ſyphon, after they are filled with ſucking. But if by the running out of the water, the outward pipe

do grow

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do grow shorter then to reach as low as the superficies of the water in the fountaine from whence it runneth; in this case, the water in each arme of the syphon, will runne backe into the fountaine.

Withall, it is to be noted, that though the arme which is out of the water be neuer so long, yet if it reach not lower then the superficies of the fountaine; the ouerquantity and weight of the water there, more then in the other arme, helpeth it nothing to make it runne out. Which is, because the decliuity of the other arme, ouercompenceth this ouerweight. Not that the weight in the shorter pipe, hath so much force as the weight in the longer pipe: but because it hath more force then the greater weight doth exercise there in its running; for the greatest part of its force, tendeth another way then to the end of the pipe; to wit, perpendicularly towardes the center. And so is hindered from effect, by the great sloaping or little decliuity of the pipe vpon which it leaneth.

6. That the syphon doth not proue, water to weigh in its owne orbe.

But some considering how the water that is in the longer arme of the syphon is more in quantity then the water that is in the other arme of it whereat it runneth out, do admire why the greater quantity of water doth not draw backe the lesse into the cisterne, but suffereth it selfe to be lifted vp, and drayned away as if it runne steeply downewardes. And they imagine, that hence may be deduced, that the partes of water in the cisterne doe not weigh as long as they are within the orbe of their owne body.

Vnto whom we answere; that they should consider how that to haue the greater quantity of water, which is in the longer arme of the syphon (which arme is immersed in the water of the cisterne) to draw backe into the cisterne the water which is in the other arme of the syphon that hangeth out in the ayre; it must, both raise as much of the water of the cisterne as its owne bulke is, aboue the leuell which att present the whole bulke of water hath; and withall it must att the same time pull vp the water which is in the other arme. Now it is manifest, that these two quantities of water together, are heauyer then the water in the sunke arme of the syphon; since one of them single, is equall vnto it. And by consequence, the more water in the sunke arme, can not weigh backe the lesse water in the hanging arme; since that, to do that, it must att the same time weigh vp ouer and aboue, as much more in the cisterne as it selfe weigheth.

But turning the argument; I say, that if once the arme of the syphon that is in the ayre, be supposed to draw any water, be it neuer so little, out of the cisterne (whether occasioned by sucking or by whatsoeuer other meanes) it followeth that as much water as is drawne vp, aboue the leuell of the whole bulke in the cisterne, must needes presse into the suncken arme from the next adiacent partes, (that is, from the bottome) to supply its emptying; and as much must of it selfe presse downe from aboue (according to its naturall course, when nothing violenteth it) to rest in

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the place, that the ascending water (which is lower then it) leaueth att liberty for it to take possession of. And then it can not be doubted; but that, this descending water, hauing all its weight in pressing downe, applyed to driue vp the rising water in the sunke arme of the syphon; and the water in the other arme of the syphon without, hauing all its weight in running out applyed att the same time to draw vp the same water in the sunke arme; this single resistant must yield to their double and mastering force. And consequently, the water in the arme of the syphon that is in the ayre, must needes draw the water that is in the other immersed arme as long as the end of its pipe reacheth lower then the leuell of the water in the cisterne; for so long it appeareth by what we haue said, it must needes be more weighty; since part of the rising water in the sunke arme of the syphon, is counterpoysed by as much descending water in the cisterne.

And thus it is euident, that out of this experiment it can not be inferred that partes of water do not weigh within the orbe of their owne whole: but onely, that two equall partes of water in their owne orbe (namely that which riseth in the sunken arme, and that which presseth downe from the whole bulke in the cisterne) are of equall weight and do ballance one an other. So that neuer so little odds between the two counterpoysing parcells of water which are in the ayre must needes make the water runne out att that end of the syphon, where the ouerweight of water is.

7. Concerning attraction caused by fire.

The attraction whose cause next to this is most manifest, is that which is made by the force of heate or of fire; for we see that fire, euer draweth ayre vnto it; so notably, that if in a close roome there be a good fire, a man that standeth att the dore or att the window (especially without) shall heare such a noise that he will thinke there is a great wind within the chamber. The reason of this attraction is, that fire rarifying the ayre which is next vnto it; and withall spending it selfe perpetually, causeth the ayre and his owne body mingled together, to fly vp through the chimney or by some other passage. Whence it followeth of necessity that the next body must succeed into the place of the body that is flowne away. This next body generally is ayre, whose mobility and fluidity beyond all other bodies, maketh it of all others the fittest to be drawne; and the more of it that is drawne the more must needes follow. Now if there be floating in this ayre any other atomes subiect to the current which the ayre taketh; they must also come with it to the fire, and by it, must be rarifyed, and be exported out of that little orbe.

Hence it is, that men (with very good reason) do hold that fire ayreth a chamber, as we terme it, that is, purifyeth it; both because it purifyeth it as wind doth by drawing a current of ayre into it that sweepeth through it, or by making it purify it selfe by motion, as a streame of water doth by running; as also, because those vapours which approach the fire, are burned

burned and dissolued. So that the ayre being noysome and vnwholesome by reason of its grossenesse, proceeding from its standing vnmoued (like a stagnation of dead water, in a marish place) the fire taketh away that cause of annoyance.

By this very rule we learne that other hoat thinges, which participate the nature of fire, must likewise (in other respects) haue a resemblance in this quality. And accordingly wee see that hoat loafes in a bakers shoppe newly drawne out of the ouen, are accounted to draw vnto them any infection which is in the ayre. The like we say of onyons, and other strong breathing substances; which by their smell shew much heate in them. In like manner it is conceiued that pigeons, and rabets, and catts easily take infection, by reason of their extraordinary warmth which they haue in themselues.

8. Concerning attractiō made by vertue of hoat bodies, amulets etc.

And this is confirmed by the practise of Physitians, who vse to lay warme pigeons newly killed to the feete, wristes, or heades of sicke persons; and young puppies to their stomakes, and sometimes certaine hoat gummes to their nauels; to draw out such vapors or humors as infest the body: for the same reason they hang amuletes of arsenike, sublimate, dryed toades or spiders, about their patients neckes, to draw vnto them venimous qualities from their bodies. Hence also it is, that if a man be strucken by a viper or a scorpion, they vse to breake the body of the beast it selfe that stung him (if they can gett it) vpon the wound: but if that beast be crawled out of their finding, they do the like by some other venimous creature; as I haue seene a bruised toad layed to the biting of a viper. And they manifestly perceiue the applyed body, to swell with the poyson sucked out from the wound, and the patient to be relieued and haue lesse poyson; in the same manner as by cupping glasses, the poyson is likewise drawne out from the wound: so that you may see, the reason of both, is the very same; or att the least very like one an other. Onely, we are to note, that the proper body of the beast out of which the venome was driuen into the wound, is more efficacious then any other to sucke it out.

And the like is to be obserued in all other kindes, that such vapors as are to be drawne, do come better and incorporate faster in bodies of like nature, then in those which haue onely the common conditions of heate and drynesse; the one of which serueth to attract; the other to fasten and incorporate into it selfe the moisture which the first draweth vnto it. So we see that water soaketh into a dry body, whence it was extracted, allmost inseparably, and is hidden in it; as when it raineth first after hoat weather, the ground is presently dryed after the shoure. Likewise we see that in most ciments, you must mingle a dust of the nature of the thinges which are to be cimented, if you will haue them bind strongly.

9. The naturall reason giuen for diuers operations, esteemed by some to be magicall.

Out of this discourse, we may yield a reason for those magicall operations, which some attribute to the Diuels assistance; peraduenture because mans wickednesse hath beene more ingenious then his good

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will; and so hath found more meanes to hurt then to helpe; nay when he hath arriued some way to helpe, those very helpes haue vndergone the same calumny; because of the likenesse which their operations haue to the others. Without doubt very vniustly, if there be truth in the effects. For where haue we any such good suggestions of the enemy of mankind proposed vnto vs, that we may with reason beleeue he would duly, settledly, and constantly concurre to the helpe and seruice of all those he so much hateth, as he must needes do if he be the Author of such effects? Or is it not a wrong to almighty God, and to his carefull instruments; rather to impute vnto the Diuell the aydes which to some may seeme supernaturall, then vnto them of whom we may iustly beleeue and expect such good officies and assistances? I meane, those operations, both good and bad, which ordinarily are called *Magneticall*, though peraduenture wrongfully, as not hauing that property which denominateth the loadestone.

One thing I may assure, that if the reportes be true, they haue the perfect imitation of nature in them. As for example; that the weapons salue, or the sympathetike pouder doth require in the vsing it, to be conserued in an equall and moderate temper: and that the weapon which made the wound, or the cloth vpon which the blood remaineth that issued from it, be orderly and frequently dressed; or else the wounded person will not be cured: likewise the steame or spirits, which att the giuing of the wound did enter into the pores of the weapon, must not be driuen out of it, (which will be done by fire; and so when it is heated by holding ouer coales, you may see a moysture sweate out of the blade att the opposite side to the fire, as farre as it entered into the wounded persons body; which being once all sweated out, you shall see no more the like steame vpon the sword) neyther must the blood be washed out of the bloody cloth; for in these cases, the pouder, or salue, will worke nothing. Likewise, if there be any excesse eyther of heate or of cold in keeping the medicated weapon or cloth; the patient feeleth that, as he would do, if the like excesse were in any remedy that were applyed to the wound it selfe: likewise if the medicated weapon or bloody cloth, be kept too close, no effect followeth: likewise, the natures of the thinges vsed in these cures are of themselues soueraigne for healing the like griefes though peraduenture too violent if they were applyed in body without much attenuation.

And truly if we will deny all effects of this kind, we must in a manner renounce all humane fayth: men of all sortes and qualities (and many of them such in my owne knowledge, as I can not question their prudence in obseruing, or their sincerity in relating) hauing very frequently made experience of such medicines, and all affirming after one fashion to haue found the same effects. Adde to these, the multitude of other like effects, appearing or conceited to appeare in other thinges. In some countries it is a familiar disease with kine to haue a swelling in the soales of their feete.

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feete: and the ordinary cure is, to cutt a turfe vpon which they haue troden with their fore foote, and to hang it vpon a hedge; and as that dryeth away, so will their fore amend. In other partes they obserue, that if milke newly come from the cowe, do in the boyling runne ouer into the fire; and that this do happen often, and neere together to the same cowes milke; that cowe will haue her vdder sore and inflamed: and the preuention is to cast salt immediately into the fire vpon the milke. The herbe *Persicaria* if it be well rubbed vpon wartes, and then be layed in some fitt place to putrify, causeth the wartes to weare away as it rotteth: some say the like of fresh beefe. Many examples also there are of hurting liuing creatures by the like meanes; which I sett not downe for feare of doing more harme by the euill inclination of some persons into whose handes they may fall; then profitt by their knowing them, vnto whom I intend this worke.

But to make these operations of nature, not incredible; lett vs remember how we haue determined that euery body whatsoeuer, doth yield some steame, or vent a kind of vapour from it selfe; and consider, how they must needes do so most of all, that are hoat and moyst, as blood and milke are, and as all woundes and sores generally are. We see that the foote of a hare or deere leaueth such an impression where the beast hath passed, as a dog can discerne it a long time after: and a foxe breatheth out so strong a vapour, that the hunters themselues can wind it a great way of, and a good while after he is parted from the place. Now ioyning this, to the experiences we haue already allowed of, concerning the attraction of heate; wee may conclude that if any of these vapours do light vpon a solide warme body, which hath the nature of a source vnto them, they will naturally congregate and incorporate there; and if those vapors be ioyned with any medicatiue quality or body, they will apply that medicament better then any surgeon can apply it. Then, if the steame of blood and spirits, do carry with it from the weapon or cloth, the balsamike qualities of the salue or pouder, and with them do settle vpon the wound; what can follow but a bettering in it? Likewise, if the steame of the corruption that is vpon the clodde, do carry the drying quality of the wind which sweepeth ouer it when it hangeth high in the ayre, vnto the sore part of the cowes foote; why is it not possible that it should dry the corruption there, as well as it dryeth it vpon the hedge? And if the steame of burned milke cā hurt by carrying fire to the dugge; why should not salt cast vpon it, be a preseruatiue against it? Or rather, why should not salt hinder the fire from being carryed thither? Since the nature of salt, alwayes hindereth and suppresseth the actiuity of fire: as we see by experience when we throw salt into the fire below, to hinder the flaming of soute in the toppe of a chimney: which presently ceaseth, when new fire from beneath doth not continue it. And thus we might proceed in sundry other effects, to declare the reason and the possibility of them; were we certaine of the truth of them: therefore we remitt this whole question, to the autority of the testimonies.

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THE NINETEENTH CHAPTER.

Of three other motions belonging to particular bodies Filtration, Reſtitution, and Electricall attraction.

1. what is Filtration; and how it is effected.

AFter theſe, lett vs caſt our eye vpon an other motion, very familiar among Alchymiſtes; which they call Filtration. It is effected by putting one end of a tongue, or labell of flannen, or of cotton, or of flaxe, into a veſſell of water, and letting the other end hang ouer the brimme of it. And it will by little and little draw all the water out of that veſſell (ſo that the end which hangeth out be lower then the ſuperficies of the water) and will make it all come ouer into any lower veſſell you will reſerue it in.

The end of this operation is, when any water is mingled with groſſe and muddy partes (not diſſolued in the water) to ſeparate the pure and light ones from the impure. By which we are taught that the lighter partes of the water, are thoſe which moſt eaſily do catch. And if we will examine in particular, how it is likely this buſineſſe paſſeth; wee may conceiue that the body or linguet by which the water aſcendeth, being a dry one, ſome lighter partes of the water, whoſe chance it is to be neere the clymbing body of flaxe, do beginne to ſticke faſt vnto it: and then, th y require nothing neere ſo great force, nor ſo much preſſing, to make them clymbe vp along the flaxe, as they would do to make them mount in the pure ayre. As you may ſee, if you hold a ſticke in running water, sh eluing againſt the ſtreame: the water will runne vp along the ſticke, much higher then it could be forced vp in the open ayre without any ſupport, though the Agent were much ſtronger then the current of the ſtreame. And a ball will vpon a rebound, runne much higher vp a sheluing board, then it would if nothing touched it. And I haue beene told that if an eggeshell filled with dew bee ſett att the foote of a hollow ſticke, the ſunne will draw it to the toppe of the sheluing ſticke, whereas without a proppe, it will not ſtirre it.

With much more reaſon then, we may conceiue that water finding as it were little ſteppes in the cotton to facilitate its iourney vpwardes, muſt aſcend more eaſily then thoſe other thinges do; ſo as it once receiue any impulſe to driue it vpwardes: for the grauity both of that water which is vpon the cotton, as alſo, of ſo many of the confining partes of water as can reach the cotton; is exceedingly allayed, eyther by ſticking vnto the cotton, and ſo weighing in one bulke with that dry body; or elſe, by not tending downe ſtraight to the center, but reſting as it were vpon a ſteepe plaine (according to what we ſaid of the arme of a ſyphon that hangeth very ſloaping out of the water, and therefore draweth not after it a leſſe proportion of water in the other arme that is more in a direct

direct line to the center:) by which meanes the water, as soone as it beginneth to clymbe, cometh to stand in a kind of cone; nether breaking from the water below,(its bulke, being bigge enough to reach vnto it)nor yet falling downe vnto it.

But our chiefe labour must be, to find a cause that may make the water beginne to ascend. To which purpose, consider how water, of its owne nature, compresseth it selfe together, to exclude any other body lighter then it is. Now in respect of the whole masse of the water, those partes which sticke to the cotton, are to be accounted much lighter then water; not, because in their owne nature they are so; but for the circumstances which accompany them, and do giue them a greater disposition to receiue a motion vpwardes then much lighter bodies, whiles they are destitute of such helpes. Wherefore, as the bulke of water weighing and striuing downewardes; it followeth that if there were any ayre mingled with it, it would, to possesse a lesser place, driue out the ayre: so here in this case, the water that is att the foote of the ladder of cotton, ready to clymbe with a very small impulse, may be after some sort compared (in respect of the water) to ayre by reason of the lightnesse of it: and consequently, is forced vp by the compressing of the rest of the water round about it. Which no faster getteth vp, but other partes att the foote of the ladder do follow the first, and driue them still vpwardes along the towe; and new ones driue the second, and others the third, and so forth. So that with ease they clymbe vp to the toppe of the filter, still driuing one an other forwardes, as you may do a fine towel through a muskett barrell: which though it be too limber to be thrust straight through; yet cramming still new partes into it att the length you will driue the first quite through.

2. What causeth the water in filtration to ascend.

And thus, when these partes of water are gott vp to the toppe of the vessell on which the filter hangeth, and ouer it on the other side by sticking still to the towe, and by their naturall gravity, against which nothing pressеth on this side the labell; they fall downe againe by little and little, and by droppes breake againe into water in the vessell sett to receiue them.

But now if you aske why, it will not droppe vnlesse the end of the labell that hangeth, be lower then the water. I conceiue it is because the water which is all along vpon the flannen, is one continued body hanging together, as it were a thridde of wyre; and is subiect to like accidents as such a continued body is. Now suppose you lay a wyre vpon the edge of the basin, which the filter resteth vpon; and so make that edge the center to ballance it vpon: if the end that is outermost be heauyest, it will weigh downe the other; otherwise, not. So fareth it with this thridde of water: if the end of it that hangeth out of the pott, that is to be filtred be longer, and consequently heauyer, then that which riseth; it must needes raise the other vpwardes, and fall it selfe downewardes. Now the raising of the

3. Why the filter will not droppe vnlesse the labell hang lower then the water.

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other, implyeth lifting more water from the ciſterne, and the ſliding of it ſelfe further downewardes, is the cauſe of its conuerting into droppes. So that the water in the ciſterne ſerueth like the flaxe vpon a diſtaffe, and is ſpunne into a thridde of water, ſtill as it commeth to the flannen by the drawing it vp, occaſioned by the ouerweight of the thridde on the other ſide of the center.

Which to expreſſe better by a ſimilitude in a ſolide body: I remēber I haue oftētimes ſeene in a Mercers shoppe, a great heap of maſſy goldlace lye vpon their ſtall; and a little way aboue it a round ſmooth pinne of wood, ouer which they vſe to hale their lace when they wind it into bottomes. Now ouer this pinne, I haue putt one end of the lace; and as long as it hung no lower thē the board vpō which the reſt of the lace did lye, it ſtirred not; for as the weight of the looſe end carried it one way, ſo the weight of the other ſide where the whole was, drew it the other way, and in this manner kept it in equilibrity. But as ſoone as I drew on the hāging end to be heauyer thē the clymbing ſide (for no more weigheth thē is in the ayre, that which lyeth vpon the board, hauing an other cēter) then it began to roule to the ground; and ſtill drew vp new partes of that which lay vpon the board, vntill all was tumbled downe vpon the floore. In the ſame manner it happeneth to the water; in which, the thridde of it vpon the filter is to be compared fittly vnto that part of the lace which hung vpon the pinne; and the whole quantity in the ciſterne, is like the bulke of lace vpon the shoppeboard; for as faſt as the filter draweth it vp, it is conuerted into a thridde like that which is already vpon the filter: in like manner as the wheele conuerteth the flaxe into yarne, as faſt as it draweth it out from the diſtaffe.

4. Of the motion of Reſtitution: and why ſome bodies ſtand bent, others not.

Our next conſideration, will very aptly fall vpon the motion of thoſe thinges, which being bent, do leape with violence to their former figure: whereas others returne but a little; and others do ſtand in that ply, wherein the bending of them hath ſett them. For finding the reaſon of which effects, our firſt reflection may be to note, that a ſuperficies which is more long then broad, containeth a leſſe floore then that whoſe ſides are equall, or neerer being equall: and that of thoſe ſurfaces whoſe lines and angles are all equall, that which hath moſt ſides and angles, containeth ſtill the greater floore. Whence it is that Mathematicians conclude a circle to be the moſt capacious of all figures: and what they ſay of lines in reſpect of a ſuperficies; the ſame, with proportion they ſay of ſurfaces in reſpect of the body contained. And accordingly we ſee by conſequence, that in the making a bagge of a long napkin, if the napkin be ſowed together longwiſe, it holdeth a great deale leſſe then if it be ſowed together broadwiſe.

By this we ſee plainely, that if any body which is in a thicke and ſhort figure, be forced into a thinner (which by becoming thinner, muſt likewiſe become eyther longer or broader; for what it looſeth one way it muſt gett an other) then that ſuperficies muſt needes be ſtretched; which

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in our caſe, is a Phyſicall outſide, or materiall part of a ſolide body, not a Mathematicall conſideration of an indiuiſible Entity. We ſee alſo that this change of figures happeneth in the bending of all thoſe bodies; whereof we are now enquiring the reaſon why ſome of them reſtore themſelues to their originall figures, and others ſtand as they are bent.

Then to begin with the latter ſort, we find that they are of a moiſt nature; as among mettalls, lead, and tinne, and among other bodies, thoſe which we account ſoft. And we may determine that this effect proceedeth, partly from the humidity of the body that ſtandeth bent; and partly from a dryneſſe peculiar to it that comprehendeth and fixeth the humidity of it. For by the firſt, they are rendred capable of being driuen into any figure, which nature or art deſireth: and by the ſecond, they are preſerued from hauing their grauity putt them out of what figure they haue once receiued.

But becauſe theſe two conditions, are common to all ſolide bodies, we may conclude, that if no other circumſtance concurred, the effect ariſing out of them would likewiſe be common to all ſuch: and therefore, where we find it otherwiſe, we muſt ſeeke further for a cauſe of that tranſgreſſion. As for example, if you bend the bodies of young trees, or the branches of others, they will returne to their due figure. It is true, they will ſometime leane towardes that way they haue beene bent: as may be ſeene, euen in great trees after violent tempeſtes; and generally the heades of trees, and the eares of corne, and the growne hedgerowes, will all bend one way in ſome countries, where ſome one wind hath a maine predominance and raigneth moſt continually, as neere the ſea-ſhore vpon the weſterne coaſt of England (where the ſouthweſt wind bloweth conſtantly the greateſt part of the yeare) may be obſerued: but this effect proceeding from a particular and extraordinary cauſe, concerneth not our matter in hand.

We are to examine the reaſon of the motion of Reſtitution, which we generally ſee in yong trees, and branches of others, as we ſaid before. In ſuch, we ſee that the earthy part which maketh them ſtiffe (or rather, ſtarke) aboundeth more in them then in the others that ſtand as they are bent: att the leaſt in proportion to their natures; but I conceiue this is not the cauſe of the effect we enquire about; but that it is a ſubtile ſpirit which hath a great proportion of fire in it. For as in rarefaction, we found that fire, which was eyther within or without the body to be rarifyed, did cauſe the rarefaction, eyther by entering into it, or by working within it: ſo ſeeing here the queſtion is, for a body to goe out of a leſſer ſuperficies into a greater (which is the progreſſe of rarefaction; and happeneth in the motion of reſtitution;) the worke muſt needes be done by the force of heate. And becauſe, this effect proceedeth euidently, out of the nature of the thing in which it is wrought, and not from any outward cauſe, we may conclude it hath its origine from a heate that is

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within the thing it ſelfe, or elſe that was in it, and may be preſſed to the outward partes of it, and would ſinke into it againe.

As for example, when a yong tree is bended; both euery mans conceite is, and the nature of the thing maketh vs beleeue, that the force which bringeth the tree backe againe to its figure, cometh from the inner ſide that is bent; which is compreſſed together, as being ſhrunke into a circular figure from a ſtraight one: for when ſolide bodies that were plaine on both ſides, are bent ſo as on each ſide to make a portion of a circle, the conuexe ſuperficies will be longer then it was before, when it was plaine, but the concaue will be shorter. And therefore we may conceiue that the ſpirits which are in the contracted part, (being there ſqueezed into leſſe roome, then their nature well brooketh) do worke themſelues into a greater ſpace; or elſe, that the ſpirits which are crushed out of the conuexe ſide by the extenſion of it, but do remaine beſieging it, and do ſtriue to gett in againe, (in ſuch manner as we haue declared when we ſpoke of attraction, wherein we shewed how the emitted ſpirits of any body will moue to their owne ſource, and ſettle againe in it, if they be within a conuenient compaſſe;) and accordingly do bring backe the extended partes to their former ſituation; or rather that both theſe cauſes do in their kindes concurre to driue the tree into its naturall figure.

5. Why ſome bodies returne onely in part to their natural figure; others entirely.

But as we ſee when a ſticke is broken, it is very hard to replace all the ſplinters, euery one in its proper ſituation; ſo it muſt of neceſſity fall out in this bending, that certaine inſenſible partes both inward and outward are thereby diſplaced, and can hardly be perfectly reioynted. Whence it followeth that as you ſee the ſplinters of a halfe broken ſticke, meeting with one an other do hold the ſticke ſomewhat crooked; ſo theſe inuiſible partes do the like in ſuch bodies as after bending ſtand a little that way. But becauſe they are very little ones, the tree or the branch that hath beene neuer ſo much bended, may (ſo nothing be broken in it) be ſett ſtraight againe by paines, without any notable detriment of its ſtrength. And thus you ſee the reaſon of ſome bodies returning in part to their naturall figure, after the force leaueth them that did bend them.

Out of which you may proceed to thoſe bodies that reſtore themſelues entirely: whereof ſteele is the moſt eminent. And of it, we know that there is a fiery ſpirit in it, which may be extracted out of it, not only by the long operations of calcining, digeſting and diſtilling it; but euen by groſſe heating it, and then extinguishing it in wine and other conuenient liquors, as Phyſitians vſe to do. Which is alſo confirmed by the burning of ſteele duſt in the flame of a candle, before it hath beene thus wrought vpon, which afterwardes it will not do: whereby we are taught that originally there are ſtore of ſpirits in ſteele, till they are ſucked out. Being then aſſured, that in ſteele there is ſuch aboundance of ſpirits; and knowing that it is the nature of ſpirits to giue a quicke motion; and

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ſeeing that duller ſpirits in trees do make this motion of Reſtitution; we neede ſeeke no further, what it is that doeth it in ſteele, or in any other thinges that haue the like nature: which through the multitude of ſpirits that abound in them (eſpecially ſteele) do returne backe with ſo ſtrong a ierke, that their whole body will tremble a great while after, by the force of its owne motion.

6. Concerning the nature of thoſe bodies which do shrinke and ſtretch.

By what is ſaid, the nature of thoſe bodies which do shrinke and ſtretch, may eaſily be vnderſtood: for they are generally compoſed of ſtringy partes, vnto which, if humidity happen to arriue, they grow thereby thicker and shorter. As we ſee that droppes of water getting into a new roape of a welle, or into a new cable, will ſwell it mueh thicker, and by conſequence, make it shorter. Galileus noteth ſuch wetting to be of ſo great efficacy, that it will shrinke a new cable, and shorten it notably; notwithſtanding, the violence of a tempeſt and the weight and ierkes of a loaden shippe, do ſtraine it what is poſſible for them to ſtretch it. Of this nature, leather ſeemeth to be, and parchment, and diuers other thinges, which if they be proportionably moyſtned, (and no exterior force be applyed to extend them) will shrinke vp; but if they be ouerwetted, they will become flaccide. Againe, if they be ſoddainely dryed, they will shriuell vp; but if they be fairely dryed after moderate wetting, they will extend themſelues againe to their firſt length.

7. How great and wonderfull effects, proceed from ſmall, plaine, and ſimple principles.

The way hauing been opened by what we haue diſcourſed, before we came to the motion of Reſtitution, towardes the diſcouery of the manner how heauy bodies may be forced vpwardes contrary to their naturall motion, by very ſmall meanes in outward appearance; lett vs now examine (vpon the ſame groundes) if like motions to this of water, may not be done in ſome other bodies in a ſubtiler manner. In which, more or leſſe, needeth not trouble vs; ſince we know, that neyther quantity, nor the operations of it, do conſiſt in an indiuiſible, or are limited to determined periodes they may not paſſe. It is enough for vs to find a ground for the poſſibility of the operation: and then the perfecting of it and the reducing it to ſuch a height as att the firſt might ſeeme impoſſible and incredibile, we may leaue to the oeconomy of wiſe nature. He that learneth to read, write, or to play on the lute, is in the beginning, ready to looſe hart att euery ſteppe; when he conſidereth with what labour, difficulty and ſlowneſſe, he ioyneth the letters, ſpelleth ſyllabes, formeth characters, fitteth and breaketh his fingers (as though they were vpon the racke) to ſtoppe the right frettes and to touch the right ſtringes. And yet you ſee how ſtrange a dexterity is gained in all theſe by induſtry and practiſe; and a readineſſe beyond what we could imagine poſſible, if we ſaw not dayly the effects.

If then we can but arriue to decypher the firſt characters of the hidden Alphabet we are now taking in hand, and can but ſpellingly reade the firſt ſyllabes of it; we neede not doubt, but that the wiſe

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Author of nature in the masterpiece of the creature (which was to expresse the excellency of the workeman) would with excellent cunning and art dispose all circumstances so aptly, as to speake readily a complete language rising from those Elements ; and that should haue as large an extent in practise and expression, beyond those first principles, which we like children onely lispe out ; as the vast discourses of wisest and most learned men, are beyond the spellinges of infantes : and yet those discourses spring from the same roote, as the others spellinges doe, and are but a raysing of them to a greater height ; as the admired musike of the best player of a lute or harpe, that euer was, is deriued from the harsh twanges of course bowestringes, which are composed together, and refined, till att length they arriue to that wonderfull perfection. And so without scruple, we may in the businesse we are next falling vpon, conclude that the admirable and almost miraculous effects we see, are but the eleuating to a wonderfull height those very actions and motions which we shall produce as causes and principles of them.

8. Concerning Electricall attraction, and the causes of it.

Letr vs then suppose, that there is a solide hard body, of an vnctuous nature; whose partes are so subtile and fiery, that with a little agitation they are much rarifyed, and do breath out in steames, (though they be too subtile for our eyes to discerne) like vnto the steame that issueth from sweating men or horses, or like the steame that flyeth from a candle when it is putt out: but that these steames, as soone as they come into the cold ayre, are by that cold soddainely condensed againe ; and by being condensed, do shorten themselues, and by little and little do retire, till they settle themselues vpon the body from whence they sprung : in such manner as you may obserue, the little tender hornes of snailes vse to shrinke backe if any thing touch them, till they settle in little lumpes vpon their heades. If I say these stringes of bituminous vapour should in their way outwardes meete with any light and spungie body, they would pierce into it, and settle in it ; and if it were of a competent biggenesse for them to wield, they would carry it with them which way soeuer they goe; so that if they shrinke backe againe to the fountaine from whence they came, they must needes carry backe with them the light spungy body they haue fixed their dartes in.

Consider then , that how much heate rarifyeth , so much cold cõdenseth: and therefore such partes as by agitatiõ were spũne out into a subtile thridde of an inch long for exãple, as they coole, do grow bigger and bigger, and consequently shorter and shorter, till att length, they gather thẽselues backe into their maine body; and there they settle againe in cold bitumen as they were att the first ; and the light body that they sticke vnto, is drawne backe with them, and consequently sticketh to the superficies of the bitumen. As if something were tyed att one end of a lutestring extended to its vtmost capacity, and the other end were fastened to some pinne; as the string shrinketh vp, so that which is tyed att it, must needes moue neerer and neerer the pinne: which artifice of nature

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iugglers do imitate, when by meanes of an vnſeene haire, they draw light bodies to them. Now if all this operation be done, without your ſeeing the little thriddes which cauſe it; the matter appeareth wonderfull and ſtrange. But when you conſider this progreſſe that we haue ſett downe, you will iudge it poſſible.

And this ſeemeth to be the caſe of thoſe bodies which we call Electricall; as yellow amber, iett, and the like. All which, are of a bituminous vnctuous nature, as appeareth by their eaſy combuſtibility and ſmell, when they are burned. And if ſome do not ſo apparently shew this vnctuous nature, it is becauſe eyther they are too hard, or elſe they haue a high degree of aqueous humidity ioyned with their vnctuoſity: and in them the operation will be duller in that proportion; for as we ſee that vnctuous ſubſtances are more odoriferous then others, and do ſend their ſteames further off, and more efficaciouſly; ſo we can not doubt but that ſuch bodies as conſiſt in a moiſt nature do accordingly ſend forth their emanations in a feebler proportion. Yet that proportion will not be ſo feeble, but that they may haue an Electricall effect, as well as the more efficacious Electricall bodies, which may be perceptible, if exact experience be made by an inſtrument like the mariners needle; as our learned countryman Doctor Gilbert teacheth.

But that in thoſe eminent agents, the ſpirits, whereby they attract, are vnctuous, is plaine, becauſe the fire conſumeth them; and ſo if the agents be ouerheated they can not worke; but moderate heate euen of fire encreaſeth their operation. Againe, they are clogged by myſty ayre, or by wetting: and likewiſe, are pierced through and cutt aſunder by ſpiritt of wine or aquæ ardentes; but oyle doth not hurt them. Likewiſe, they yield more ſpirits in the ſunne then in the ſhade; and they continue longer, when the ayre is cleared by North or by Eaſterne windes. They require to be polished, eyther becauſe the rubbing which polisheth them, doth take off from their ſurfaces the former emanations, which returning backe do ſticke vpon them, and ſo do hinder the paſſage of thoſe that are within; or elſe, becauſe their outſides may be foule; or laſtly, becauſe the pores may be dilated by that ſmoothing. Now that hardneſſe and ſolidity is required; doth argue that theſe ſpirits muſt be quicke ones, that they may returne ſmartly, and not be loſt through their languishing in the ayre. Likewiſe, that all bodies which are not eyther exceeding rare, or elſe ſett on fire, may be drawne by theſe vnctuous thriddes; concludeth that the quality by which they do it, is a common one that hath no particular contrarieties; ſuch a one as we ſee is in greaſe or in pitch to ſticke to any thing; from which, in like manner nothing is exempted but fire and ayre. And laſtly, that they worke moſt efficaciouſly, when they are heated by rubbing, rather then by fire; sheweth that their ſpirits are excitated by motion, and are thereby made to flye abroad; in ſuch manner as we ſee in pomanders, and in other perfumes, which muſt be heated if you will haue them

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communicate their ſent: and alike effect as in them, agitation doth in iett, yellow amber, and ſuch other Electricall bodies; for if vpon rubbing them, you putt them preſently to your noſe, you will diſcerne a ſtrong bituminous ſmell in them; all which circumſtances do ſhew that this Electricall vertue, conſiſteth in a certaine degree of rarity or denſity of the bodies vnctuous emanations.

Now if theſe refined and viſcous thriddes of iett or amber, do in their ſtreaming abroad meete with a piece of ſtraw, or of hay, or of a dryed leafe, or ſome ſuch light and ſpungy body; it is no maruayle if they glew themſelues vnto it like birdlime; and that in their ſhrinking backe (by being condenſed againe and repulſed, through the coldneſſe of the ayre) they carry it along with them to their entire body. Which they that onely ſee the effect, and can not penetrate into a poſſibility of a naturall cauſe thereof, are much troubled withall.

9. Cabeus his opinion refuted concerning the cauſe of Electricall motions.

And this ſeemeth vnto me to beare a fairer ſemblance of truth, then what Cabeus deliuereth for cauſe of Electricall attractions. Whoſe ſpeculation herein, though I can not allow for ſolide, yet I muſt for ingenious. And certainely euen errors are to be commended, when they are witty ones, and do proceed from a caſting further about, then the beaten tracke of verball learning, or rather termes which explicate not the nature of the thing in queſtion. He ſayth that the coming of ſtrawes and ſuch other light bodies vnto amber, iett, and the like, proceedeth from a wind rayſed by the forcible breaking out of ſubtile emanations from the Electricall bodies into the ayre, which bringeth thoſe light bodies along with it to the Electricall ones.

But this diſcourſe can not hold: for firſt, it is not the nature of vnctuous emanations (Generally ſpeaking) to cauſe ſmart motions ſingly of themſelues. Secondly, although they ſhould rayſe a wind, I do not comprehend how this wind ſhould driue bodies directly backe to the ſource that rayſed it; but rather any other way; and ſo conſequently, ſhould driue the light bodies it meeteth with in its way, rather from, then towardes the Electricall body. Thirdly, if there ſhould be ſuch a wind rayſed, and it ſhould bring light bodies to the Electricall ones; yet it could not make them ſticke therevnto, which we ſee they do, turne them which way you will, as though they were glewed together.

Neyther do his experiences conuince any thing; for what he ſayth that the light bodies are ſometimes brought to the Electricall body with ſuch a violence, that they rebound backe from it, and then returne againe to it, maketh rather againſt him: for if wind were the cauſe of their motion, they would not returne againe, after they had leaped backe from the Electricall body; no more then we can imagine that the wind it ſelfe doth.

The like is of his other experience, when he obſerued that ſome little graines of ſawduſt hanging att an Electricall body, the furthermoſt of them

them not onely fell of, but ſeemed to be driuen away forcibly: for they did not fall directly downe, but ſideways; and beſides did fly away with a violence and ſmartneſſe that argued ſome ſtrong impulſe. The reaſon whereof might be, that new emanations might ſmite them, which not ſticking and faſtening vpon them, whereby to draw them neerer, muſt needes push them further: or it might be that the emanations vnto which they were glewed, shrinking backe vnto their maine body, the latter graines were shouldered of by others that already beſieged the ſuperficies; and then the emanations retiring ſwiftly the graines muſt breake of with a force: or elſe, we may conceiue it was the force of the ayre that bore them vp a little, which made an appearance of their being driuen away; as we ſee feathers and other light thinges deſcend not ſtraight downe.

THE TWENTIETH CHAPTER.

Of the Loadſtones generation; and its particular motions.

THere is yet remaining, the great myſtery of the Loadſtone to diſcourſe of. Which all Authors, both auntient and moderne, haue agreed vpon as an vndenyable example and euidence, of the shorteneſſe of mans reach in comprehending, and of the impoſſibility of his reaſon in penetrating into, and explicating ſuch ſecrets, as nature hath a mind to hide from vs. Wherefore our reader (I am ſure) will not in this ſubiect expect cleare ſatisfaction or plaine demonſtrations, att our handes: but will iugde we haue fairely acquitted our ſelues, if what we ſay be any whitt plauſible.

1. The extreme heat of the ſunne vnder the zodiake, draweth a ſtreame of ayre from each Pole into the torride zone.

Therefore, to vſe our beſt endeauours to content him; lett vs reflect vpon the diſpoſition of partes of this habitable globe, whereof we are tenants for liues. And we shall find that the ſunne by his conſtant courſe vnder the zodiake, heateth a great part of it vnmeaſurably more then he doth the reſt. And conſequently, that this zodiake being in the middeſt betweene two (as it were) endes, which we call the Poles, theſe poles muſt neceſſarily be extremely cold, in reſpect of the torride zone; for ſo we call that part of the earth which lyeth vnder the zodiake.

Now looking into the conſequence of this; we find that the ſunne, or the ſunnes heate which reflecteth from the earth in the torride zone, muſt rarify the ayre extremely, and according to the nature of all heate and fire, muſt needes carry away from thence, many partes of the ayre and of the earth ſticking to that heate, in ſuch ſort as we haue formerly declared.

Whence it followeth, that other ayre muſt neceſſarily come from the regions towardes both the poles, to ſupply what is carryed away from the middle, as is the courſe in other fires, and as we haue explicated aboue:

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Chap. 18. §. 7.

especially cõsidering, that the ayre which cometh from the polewardes, is heauyer then the ayre of the torride zone; and therefore, must naturally presse to be still neerer the earth; and so, as it were shouldereth vp the ayre of the torride zone towardes the circumference, by rouling into its place: and this, in great quantities; and consequently, the polar ayre must draw a great trayne after it.

Which if we consider the great extent of the torride zone, we shall easily persuade our selues, that it must reach on each side, to the very pole: for taking from Archimedes, that the spherical superficies of a portion of a sphere, is to the superficies of the whole sphere, according as the part of the axis of that sphere comprised within the said portion, is to the whole axis: and considering that (in our case) the part of the axis comprised within the torride zone, is to the whole axis of the earth, in about the proportion of 4. to 10; it must of necessity follow that a fire or great heate raigning in so vast an extent, will draw ayre very powerfully from the rest of the world.

Neyther lett any man apprehend that this course of the sunnes eleuating so great quantities of atomes in the torride zone, should hinder the course of grauity there: for first the medium is much rarer in the torride zone then in other partes of the earth; and therefore the force of the descending atomes, needeth not to be so great there as in other places, to make bodies descend there as fast as they do elsewhere. Secondly, there being a perpetuall supply of fresh ayre from the polar partes, streaming continually into the torride zone; it must of necessity happen that in the ayre there come atomes to the torride zone, of that grossenesse that they can not soddainely be so much rarifyed as the subtiler partes of ayre that are there: and therefore, the more those subtiler partes are rarifyed, and thereby happen to be carried vp, the stronger and the thicker the heauyer atomes must descend. And thus this concurse of ayre from the polar partes, mainetayneth grauity vnder the zodiake; where otherwise all would be turned into fire, and so haue no grauity.

2. The atomes of these two streames coming together are apt to incorporate with one an other.

Now, who cõsidereth the two hemispheres which by the æquator are diuided; will find that they are not altogether of equall complexions; but that our hemisphere, in which the North pole is comprised, is much dryer then the other, by reason of the greater cõtinent of land in this, and the vaster tract of sea in the other; and therefore the supply which cometh frõ the diuers hemispheres, must needes be of differẽt natures; that which cometh from towardes the South pole, being compared to that which cometh frõ towardes the North, as the more wett to the more dry. Yet of how different cõplexions soeuer they be, you see they are the emanations of one and the same body. Not vnlike vnto what nature hath instituted in the ranke of animals: among whom, the male and the female are so distinguished by heate and cold, moysture and drought; that neuertheless all belongeth, but to one nature; and that, in degrees though

though manifestly different, yet so neere together that the body of one is in a manner the same thing, as the body of the other. Euen so, the complexions of the two hemispheres are in such sort different in the same qualities, that neuertheleſſe they are of the same nature; and are vnequall partes of the same body which we call the earth. Now Alchymistes assure vs, that if two extractions of one body do meete together they will incorporate one with the other; especially, if there be some little difference in the complexion of the extractions.

3. By the meeting and mingling together of these streames att the Equator, diuers riuolets of atomes of each Pole, are continuated from one Pole to the other.

Whence it followeth that these two streames of ayre, making vp one continuate floud of various currents, from one end of the world to the other; each streame that cometh to the equator from its owne Pole, by the extraction of the sunne, and that is still supplyed with new matter flowing from its owne pole to the æquator, before the sunne can sufficiently rarify and lift vp the atomes that came first perpendicularly vnder its beames (as it vseth to happen in the effects of Physicall causes, which can not be rigorously aiusted, but must haue some latitude; in which, nature inclineth euer rather to aboundance then to defect,) will passe, euen to the other pole, by the conduct of his fellow, in case he be by some occasion driuen backe homewardes.

For as we see in a boule or paile full of water, or rather in a pipe, through which the water runneth along; if there be a little hole att the bottome or side of it, the water will wriggle and change its course to creepe out att that pipe; especially if there be a little spigott, or quill att the outside of the hole, that by the narrow length of it helpeth in some sort (as it were) to sucke it. So if any of the files of the army or flould of atomes sucked from one of the Poles to the æquator, do there find any gappes, or chinkes, or lanes of retiring files in the front of the other poles batalia of atomes, they will presse in there: in such manner as we haue aboue declared that water doth by the helpe of a labell of cotton; and as is exemplyfied in all the attractions of venime by venimous bodies whereof we haue giuen many examples aboue: and they will go along with them the course they goe. For as when a thicke short guilded ingott of siluer is drawne out into a long subtile wyre; the wyre continuing still perfectly guilded all ouer, doth manifestly shew that the outside and the inside of the ingott, do strangely meete together, and intermixe in the drawing out: so this little streame which (like an eddy current) runneth backe from the æquator towardes its owne Pole, will continue to the end still tincted with the mixture of the other Poles atomes, it was incorporated with att its coming to the æquator.

Now that some little riuolets of ayre and atomes should runne backe to their owne Pole, contrary to the course of their maine streame will be easily enough to conceiue; if we but consider that att certaine times of the yeare windes do blow more violently and strongly from some determinate part or Rombe of the world, then they do att other times and from other partes. As for example; our East India Mariners tell vs of the

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famous Monsones they find in those partes; which are strong windes that raigne constantly six monthes of the yeare from one pole wardes, and the other six monthes, from the other pole, and beginne precisely about the sunnes entering into such a signe or degree of the zodiake, and continue till about its entrance into the opposite degree. And in our partes of the world certaine smart Easterly or Northeasterly windes do raigne about the end of March and beginning of Aprill; when it seemeth that some snowes are melted by the spring heates of the sunne. And other windes haue their courses in other seasons, vpon other causes. All which do euidently conuince, that the course of the ayre, and of vapors from the poles to the equator, can not be so regular and vniforme, but that many impediments and crosses, do light in the way, to make breaches in it; and thereby to force it in some places to an opposite course. In such sort as we see happeneth in eddy waters, and in the course of a tide, wherein the streame running swiftly in the middle, beateth the edges of the water to the shore, and thereby maketh it runne backe att the shore. And hence we may conclude, that although the maine course of ayre and atomes (for example from north to south, in our hemisphere) can neuer faile of going on towardes the æquator, constantly att the same rate, in grosse; neuerthlesse, in seuerall particular little partes of it (and especially att the edges of those streames that are driuen on faster then the rest, by an extraordinary and accidentall violent cause) it is variously interrupted, and sometimes entirely stopped, and other times euen driuen backe to the northwardes.

And if peraduenture any man should thinke that this will not fall out, because each streame seemeth to be alwayes coming from his owne Pole to the æquator, and therefore will oppose and driue backe any bodies that with lesse force should striue to swimme against it; or if they sticke vnto them, will carry them backe to the æquator. We answere, that we must not conceiue that the whole ayre in body doth euery where equally encroach from the polewardes vpon the torride zone; but, as it were in certaine brookes or riuolets, according as the contingency of all causes putt together doth make it fall out.

Now then out of what we haue said it will follow; that since all the ayre in this our hemisphere is as it were strewed ouer and sowed with aboundance of northerne atomes, and that some brookes of them are in station, others in a motion of retrogradation backe to their owne north pole; the southerne atomes (which coming vpon them att the equator do not onely presse in among them, whersoeuer they can find admittance, but do also go on fowardes to the north pole in seuerall files by themselues, being driuen that way by the same accidentall causes, which make the others retire backe) seising in their way vpon the northerne ones in such manner as we described in filtration; and thereby creeping along by them whersoeuer they find them standing still, and going along with them, whersoeuer they find them going backe; must of necessity

of neceſſity find paſſage in great quantities towardes, and euen to the north pole; though ſome partes of them will euer and anone be checked in this their iourney, by the maine current preuayling ouer ſome accidentall one, and ſo be carried backe againe to the æquator, whoſe line they had croſſed.

And this effect can not chooſe but be more or leſſe according to the ſeaſons of the yeare: for when the ſunne is in the Tropike of Caprieorne, the ſoutherne atomes will flow in much more aboundance, and with farre greater ſpeede, into the torride zone, then the northerne atomes can; by reaſon of the ſunnes approximation to the ſouth, and his diſtance from the north pole; ſince he worketh fainteſt, where he is furtheſt off: and therefore from the north no more emanations or atomes will be drawne, but ſuch as are moſt ſubtiliſed, and duly prepared for that courſe. And ſince onely theſe ſelected bandes do now march towardes the æquator, their files muſt needes be thinner, then when the ſunnes being in the æquator or Tropike of Cancer wakeneth and muſtereth vp all their forces. And conſequently, the quiett partes of ayre betweene their files (in which like atomes are alſo ſcattered) are the greater: whereby the aduenient ſoutherne atomes haue the larger filter to clymbe vp by. And the like happeneth in the other hemiſphere, when the ſunne is in the Tropike of Cancer; as who will beſtow the paines to compare them, will preſently ſee.

4. Of theſe atomes incorporated with ſome fitt matter in the bowels of the earth, is made a ſtone.

Now then lett vs conſider what theſe two ſtreames thus incorporated muſt of neceſſity do in the ſurface or vpper partes of the earth. Firſt it is euident they muſt needes penetrate a pretty depth into the earth; for ſo freeſing perſuadeth vs, and much more, the ſubtile penetration of diuers more ſpirituall bodies, of which we haue ſufficiently diſcourſed aboue. Now lett vs conceiue that theſe ſteames, do find a body of a conuenient denſity to incorporate themſelues in, in the way of denſity, as we ſee that fire doth in iron, and in other denſe bodies: and this not for an houre or two as happeneth in fire; but for yeares: as I haue beene told that in the extreme cold hilles in the Peake in Darbyshire happeneth to the dry atomes of cold, which are permanently incorporated in water by long continuall freeſing and ſo make a kind of chryſtall.

In this caſe, certainely it muſt come to paſſe that this body will become in a māner wholy of the nature of theſe ſteames: which becauſe they are drawne from the Poles that abound in cold and dryneſſe, (for others that haue not theſe qualities, do not contribute to the intended effect) the body is apteſt to become a ſtone: for ſo we ſee that cold and drought,

5. This ſtone worketh by emanations, ioyned with agreeing ſtreames that meete them in the ayre; and in fine it is a loadeſtone.

turneth the ſuperficiall partes of the earth into ſtones and rockes; and accordingly, whereſoeuer cold and dry windes raigne powerfully, all ſuch countries are mainely rocky.

Now then lett vs ſuppoſe, this ſtone to be taken out of the earth and hanged in the ayre, or ſett conueniently vpon ſome little pinne, or otherwiſe putt in liberty, ſo as a ſmall impulſe may eaſily turne it any way:

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it will in this caſe certainely follow that the end of the ſtone which in the earth lay towardes the north pole, will now in the ayre conuert it ſelfe in the ſame manner towardes the ſame point; and the other end which lay towardes the ſouth, turne by conſequence to the ſouth. I ſpeake of theſe countries which lye betweene the æquator and the North; in which it can not chooſe but that the ſtreame going from the north to the æquator, muſt be ſtronger then the oppoſite one.

Now to explicate, how this is done; ſuppoſe the ſtone hanged eaſt and weſt freely in the ayre; the ſtreame which is drawne from the north pole of the earth rangeth along by it in its courſe to the æquator; and finding in the ſtone the ſouth ſteame, (which is growne innate to it) very ſtrong, it muſt needes incorporate it ſelfe with it; and moſt, by thoſe partes of the ſteame in the ſtone which are ſtrongeſt: which are they that come directly from the North of the ſtone; by which I meane that part of the ſtone that lay northward in the earth, and that ſtill looketh to the north pole of the earth now it is in the ayre. And therefore the great flood of atomes coming from the north pole of the earth will incorporate it ſelfe moſt ſtrongly, by the north end of the ſtone with the little flood of ſoutherne atomes it findeth in the ſtone: for that end ſerueth for the coming out of the ſoutherne atomes, and ſendeth them abroad; as the ſouth end doth the northerne ſteame, ſince the ſteames do come in att one end, and do go out att the oppoſite end.

From hence we may gather, that this ſtone will ioyne and cleaue to its attractiue, whenſoeuer it happeneth to be within the ſphere of its actiuity. Beſides if by ſome accident it ſhould happen that the atomes or ſteames which are drawne by the ſunne from the Polewardes to the æquator, ſhould come ſtronger from ſome part of the earth, which is on the ſide hand of the Pole, then from the very Pole it ſelfe; in this caſe the ſtone will turne from the Pole towardes that ſide. Laſtly, whatſoeuer this ſtone will do towardes the Pole of the earth; the very ſame a leſſer ſtone of the ſame kind will do towardes a greater. And if there be any kind of other ſubſtance that hath participation of the nature of this ſtone, ſuch a ſubſtance will behaue it ſelfe towardes this ſtone, in the ſame manner, as ſuch a ſtone behaueth it ſelfe towardes the earth: all the Phenomens whereof, may be the more plainely obſerued, if the ſtone be cutt into the forme of the earth.

And thus, we haue found a perfect delineation of the loadeſtone from its cauſes: for there is no man ſo ignorant of the nature of a loadeſtone, but he knoweth that the properties of it are to tend towardes the North; to vary ſometimes; to ioyne with an other loadeſtone; to draw iron vnto it; and ſuch like, whoſe cauſes you ſee deliuered.

But to come to experimentall proofes and obſeruations vpon the loadeſtone by which it will appeare, that theſe cauſes are well eſteemed

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6. A methode for making experiences vpon any subiect.

and applyed, we must be beholding to that admirable searcher of the nature of the loadestone Doctor Gilbert; by meanes of whom and of Doctor Haruey, our Natiō may claime euen in this latter age as deserued a crowne for solide Philosophicall learning, as for many ages together it hath done formerly for acute and subtile speculations in Diuinity. But before I fall to particulars, I thinke it worth warning my Reader, how this great man arriued to discouer so much of Magneticall Philosophy; that he likewise, if he be desirous to search into nature, may by imitation aduance his thoughts and knowledge that way.

In short then, all the knowledge he gott of this subiect, was by forming a little loadestone into the shape of the earth. By which meanes he compassed a wonderfull designe, which was, to make the whole globe of the earth maniable: for he found the properties of the whole earth, in that little body; which he therefore called a Terrella, or little earth; and which he could manage and trye experiences vpon, att his will. And in like manner, any man that hath an ayme to aduance much in naturall sciencies, must endeauour to draw the matter he enquireth of, into some small modell, or into some kind of manageable methode; which he may turne and wind as he pleaseth. And then lett him be sure, if he hath a competent vnderstanding, that he will not misse of his marke.

7. The Loadestones generatiō by atomes flowing from both Poles, is confirmed by experiments obserued in the stone it selfe.

But to our intent; the first thing we are to proue is, that the loadestone is generated in such sort as we haue described: for proofe whereof, the first ground we will lay, shall be to consider how in diuers other effects it is manifest, that the differences of being exposed to the north or to the south, do cause very great variety in the same thing: as hereafter, we shall haue occasion to touch, in the barkes and graines of trees, and the like. Next, we find by experience, that this vertue of the loadestone is receiued into other bodies that resemble its nature, by heatinges and coolinges: for so it passeth in iron barres, which being throughly heated, and then layed to coole north and south, are thereby imbued with a Magnetike vertue; heate opening their bodies, and disposing them to sucke in, such atomes as are conuenient to their nature, that flow vnto them whiles they are cooling. So that we can not boubt, but that conuenient matter fermenting in its warme bed vnder the earth, becometh a loadestone by the like sucking in of affluent streames of a like complexion to the former.

And it fareth in like manner with those fiery instruments (as fireforkes, tonges, shouels, and the like) which do stand constantly vpwardes and downewardes; for they, by being often heated and cooled againe, do gaine a very strong verticity, or turning to the Pole: and indeede, they can not stand vpwardes and downewardes so little a while, but that they will in that short space gaine a manifest verticity; and change it att euery turning. Now since the force and vigour of this verticity, is in the end that standeth downewardes; it is euident that this effect proceedeth out

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of an influence receiued from the earth.

And becauſe in a loadeſtone (made into a globe, or conſidered ſo, to the end you may reckon hemiſpheres in it, as in the great earth) eyther hemiſphere giueth vnto a needle touched vpon it, not onely the vertue of that hemiſphere where it is touched, but likewiſe the vertue of the contrary hemiſphere; we may boldly conclude that the vertue which a loadeſtone is impregnated with in the wombe or bed of the earth, where it is formed and groweth, proceedeth as well from the contrary hemiſphere of the earth, as from that wherein it lyeth; in ſuch ſort, as we haue aboue deſcribed. And as we feele oftentimes in our owne bodies, that ſome cold we catch remaineth in vs a long while after the taking it, and that ſometimes it ſeemeth euen to change the nature of ſome part of our body into which it is chiefely entered, and hath taken particular poſſeſſion of; ſo that whenſoeuer new atomes of the like nature, do againe range about in the circumſtant ayre, that part ſo deepely affected with the former ones of kinne to theſe, doth in a particular manner ſeeme to riſſent them, and to attract them to it, and to haue its gueſtes within it (as it were) wakened and rouſed vp by the ſtroakes of the aduenient ones that knocke att their dores. Euen ſo (but much more ſtrongly; by reaſon of the longer time and leſſe hinderances) we may conceiue that the two vertues or atomes proceeding from the two different hemiſpheres, do conſtitute a certaine permanent and conſtant nature in the ſtone that imbibeth them: which then, we call a loadeſtone; and is exceeding ſenſible (as we ſhall hereafter declare) of the aduenience to it of new atomes, alike in nature and complexion to thoſe that it is impregnated with.

And this vertue, conſiſting in a kind of ſofter and tenderer ſubſtance then the reſt of the ſtone, becometh thereby ſubiect to be conſumed by fire. From whence we may gather the reaſon why a loadeſtone neuer recouereth its magnetike vertue, after it hath once loſt it; though iron doth: for the humidity of iron, is inſeparable from its ſubſtance; but the humidity of a loadeſtone which maketh it capable of this effect, may be quite conſumed by fire; and ſo the ſtone be left too dry, for euer being capable of imbibing any new influence from the earth, vnleſſe it be by a kind of new making it.

8. Experiments to proue that the loadeſtone worketh by emanations meeting with agreeing ſtreames.

In the next place we are to proue that the loadeſtone doth worke in that manner as we haue shewed, for which end lett vs conſider how the atomes, that are drawne from each Pole and hemiſphere of the earth to the æquator, making vp their courſe by a manuduction of one an other, the hindermoſt can not chooſe but ſtill follow on after the foremoſt. And as it happeneth in filtration by a cotton cloth; if ſome one part of the cotton, haue its diſpoſition to the aſcent of the water, more perfect and ready then the other partes haue; the water will aſſuredly aſcend faſter in that part, then in any of the reſt: ſo, if the atomes do find a greater diſpoſition for their paſſage, in any one part of the medium they

they range through, then in an other, they will certainely, not faile of taking that way, in greater aboundance; and with more vigour and strength, then any other.

But it is euident, that when they meete with such a stone as we haue described, the helpes by which they aduance in their iourney, are notably encreased by the floud of atomes which they meete coming out of that stone; which being of the nature of their opposite pole, they seise greedily vpon them, and thereby do plucke themselues faster on: like a ferryman that draweth on his boate the swiftlyer, the more vigourously he tuggeth and pulleth att the rope that lyeth thwart the riuer for him to hale himselfe ouer by. And therefore we can not doubt but that this floud of atomes streaming from the pole of the earth, must needes passe through that stone with more speed and vigour then they can do any other way.

And as we see in the running of water; that if it meeteth with any lower cranies then the wide channell it streameth in; it will turne out of its straight way, to glide along there where it findeth an easier and more decliue bed to tumble in: so these atomes will infallibly deturne themselues from their direct course, to passe through such a stone as farre as their greater conueniency leadeth them.

And what we haue said of these atomes which from the Poles do range through the vast sea of ayre to the æquator; is likewise to be applyed vnto those atomes which issue out of the stone: so that we may conclude, that if they meete with any helpe which may conuey them on with more speede and vigour, then whiles they streame directly forwardes; they will likewise deturne them selues from directly forwardes, to take that course. And if the stone it selfe be hanged so nicely, that a lesse force is able to turne it about then is requisite to turne awry out of its course the continued streame of atomes which issueth from the stone: in this case, the stone it selfe must needes turne towardes that streame which clymbing and filtring it selfe along the stones streame, draweth it out of its course; in such sort as the nose of a weathercocke butteth it selfe into the wind. Now then; it being knowne, that the strongest streame cometh directly, from the north in the great earth, and that the souththerne streame of the Terrella or loadestone proportioned duely by nature to incorporate with the north streame of the earth, issueth out of the north end of the stone; it followeth plainely that when a loadestone is situated att liberty, its north end must necessarily turne towardes the north pole of the world.

And it will likewise follow, that whensoeuer such a stone meeteth with an other of the same nature and kind; they must comport themselues to one an other in like sort: that is, if both of them be free and equall, they must turne themselues to, or from, one an other; according as they are situated in respect of one an other. So that if their axes be parallele, and the south pole of the one, and the north of the other do looke the same way; then they will send proportionate, and

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agreeing ſtreames to one an other from their whole bodies, that will readily mingle and incorporate with one an other, without turning out of their way or ſeeking any shorter courſe or changing their reſpects to one an other.

But if the poles of the ſame denomination do looke the ſame way, and the loadeſtones do not lye in ſuch ſort as to haue their axes parallele, but that they encline to one an other: then they will worke themſelues about, vntill they grow by their oppoſite poles into a ſtraight line; for the ſame reaſon as we haue shewed of a loadeſtones turning to the pole of the earth.

But if onely one of the loadeſtones be free and the other be fixed, and that they lye inclined, as in the former caſe; then, the free ſtone will worke himſelfe vntill his pole be oppoſite to that part of the fixed ſtone from whence the ſtreame which agreeth with him, iſſueth ſtrongeſt: for that ſtreame is to the free loadeſtone, as the northerne ſtreame of the earth, is to a loadeſtone compared vnto the earth. But withall, we muſt take notice that in this our diſcourſe, we abſtract from other accidents; and particularly from the influence of the earthes ſtreames into the loadeſtones: which will cauſe great variety in theſe caſes, if they lye not due north and ſouth, when they beginne to worke.

And as loadeſtones and other magnetike bodies, do thus of neceſſity turne to one an other when they are both free; and if one of them be faſtened, the other turneth to it; ſo likewiſe, if they be free to progreſſiue motion, they muſt by a like neceſſity and for the ſame reaſon, come together and ioyne themſelues to one an other. And if only one of them be free, that muſt remoue it ſelfe to the other: for, the ſame vertue that maketh them turne, (which is, the ſtrength of the ſteame) will likewiſe (in due circumſtances) make them come together; by reaſon that the ſteames which clymbe vp one an other by the way of filtration, and do thereby turne the bodies of the ſtones vpon their centers when they are only free to turne, muſt likewiſe, draw the whole bodies of the ſtones entirely out of their places, and make them ioyne, when ſuch a totall motion of the body is an effect that requireth no more force, then the force of conueying vigorouſly the ſtreames of both the Magnetike bodies into one an other; that is, when there is no ſuch impediment ſtanding in the way of the Magnetike bodies motion, but that the celerity of the atomes motion, mingling with one an other, is able to ouercome it: for then, it muſt needes do ſo; and the magnetike body by naturall coherence vnto the ſteame of atomes in which it is inuolued, followeth the courſe of the ſteame: in ſuch ſort as in the example we haue heretofore vpon an other occaſion giuen of an eggeshell filled with deaw; the ſunnebeames conuerting the deaw into ſmoake, and raiſing vp that ſmoake or ſteame, the eggeshell is likewiſe raiſed vp for company with the ſteame that iſſueth from it.

And for the ſame reaſon it is, that the loadeſtone draweth iron: for iron

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iron being of a nature apt to receiue and harbour the ſteames of a loadeſtone; it becometh a weake loadeſtone; and worketh towardes a loadeſtone, in ſuch ſort as a weaker loadeſtone would do: and ſo moueth, towardes a loadeſtone by the meanes we haue now deſcribed. And that this conformity between iron and the loadeſtone, is the true reaſon of the loadeſtones drawing of iron, is cleare out of this; that a loadeſtone will take vp a greater weight of pure iron, then it will of impure or droſſy iron; or of iron and ſome other mettall ioyned together; and that it will draw further through a ſlender long iron, then in the free open ayre: all which, are manifeſt ſignes, that iron cooporateth with the force, which the loadeſtone grafteth in it. And the reaſon why iron cometh to a loadeſtone more efficaciouſly then an other loadeſtone doth, is, becauſe loadeſtones generally are more impure then iron is (as being a kind of oore or mine of iron) and haue other extraneous and heterogeneall natures mixed with them: whereas iron receiueth the loadeſtones operation in its whole ſubſtance.

THE ONE AND TWENTIETH CHAPTER.

Poſitions drawne out of the former doctrine, and confirmed by experimenrall proofes.

THE firſt poſition is, that the working of the loadeſtone, being throughout according to the tenour of the operation of bodies, may be done by bodies, and conſequently is not done by occult or ſecret qualities. Which is euident out of this, that a greater loadeſtone hath more effect then a leſſer: and that if you cutt away part of a loadeſtone, part of his vertue is likewiſe taken from him: and if the partes be ioyned againe, the whole becometh as ſtrong as it was before. 1. The operations of the loadeſtone are wrought by bodies and not by qualities.

Againe; if a loadeſtone touch a longer iron, it giueth it leſſe force then if it touch a shorter iron: nay, the vertue in any part, is ſenſibly leſſer, according as it is further from the touched part. Againe; the longer an iron is in touching, the greater vertue it getteth, and the more conſtant. And both an iron and a loadeſtone may looſe their vertue, by long lying out of their due order and ſituation, eyther to the earth or to an other loadeſtone.

Beſides; if a loadeſtone do touch a long iron in the middle of it, he diffuſeth his vertue equally towardes both endes; and if it be a round plate, he diffuſeth his vertue equally to all ſides.

And laſtly, the vertue of a loadeſtone, as alſo of an iron touched, is loſt by burning it in the fire. All which ſymptomes agreeing exactly with the rules of bodies, do make it vndenyable that the vertue of the loadeſtone is a reall and ſolide body.

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2. Obiections against the former positiō answered.

Against this position, Cabeus obiecteth that little atomes would not be able to penetrate all sortes of bodies; as we see the vertue of the loadestone doth. And vrgeth, that although they should be allowed to do so, yet they could not be imagined to penetrate thicke and solide bodies so soddainely, as they would do thinne ones; and would certainely shew then some signe of facility or difficulty of passing, in the interposition and in the taking away of bodies putt betweene the loadestone and the body it worketh vpon. Secondly he obiecteth that atomes being little bodies, they can not moue in an instant; as the working of the loadestone seemeth to do. And lastly; that the loadestone, by such aboundance of continuall euaporations, would quickely be consumed.

To the first, we answere; that atomes whose nature it is to pierce iron, can not reasonably be suspected of inability to penetrate any other body: and that atomes can penetrate iron, is euident in the melting of it by fire. And indeed this obiection cometh now too late, after we haue so largely declared the diuisibility of quantity, and the subtility of nature in reducing all thinges into extreme small partes: for this difficulty hath no other auow, then the tardity of our imaginations in subtilising sufficiently the quantitatiue partes that issue out of the loadestone.

As for any tardity that may be expected by the interposition of a thicke or dense body; there is no appearance of such, since we see light passe through thicke glasses without giuing any signe of meeting with the least opposition in its passage, (as we haue aboue declared att large:) and magneticall emanations haue the aduantage of light in this, that they are not obliged to straight lines, as light is.

Lastly, as for loadestones spending of themselues by still venting their emanations; odoriferous bodies furnish vs with a full answere to that obiection: for they do continue many yeares palpably spending of themselues, and yet keepe their odour in vigour; whereas a loadestone, if it be layed in a wrong position will not continue halfe so long. The reason of the duration of both which, maketh the matter manifest and taketh away all difficulty: which is, that as in a roote of a vegetable, there is a power to change the aduenient iuice into its nature; so is there in such like thinges as these, a power to change the ambient ayre into their owne substance: as euident experience sheweth in the Hermetike salt, (as some moderne writers call it) which is found to be rapayred, and encreased in its weight, by lying in the ayre; and the like happeneth to saltpeter. And in our present subiect, experience informeth vs, that a loadestone will grow stronger by lying in due position eyther to the earth, or to a stronger loadestone, whereby it may be better impregnated, and as it were feed it selfe with the emanatiōs issuing out of them into it.

3. The loadestone is imbued with his vertue from an other body.

Our next position is, that this vertue cometh to a magnetike body, from an other body; as the nature of bodies is, to require a being moued, that they may moue. And this is euident in iron; which by the touch, or by standing in due position neere the loadestone gaineth the power

power of the loadeſtone. Againe, if a ſmith in beating his iron into a rodde, do obſerue to lay it north and ſouth; it getteth a direction to the north, by the very beating of it. Likewiſe if an iron rodde be made red hoat in the fire, and be kept there a good while together, and when it is taken out, be layed to coole iuſt north and ſouth; it will acquire the ſame direction towardes the north. And this is true, not only of iron, but alſo of all other ſortes of bodies whatſoeuer that endure ſuch ignition: particularly, of pottearthes, which if they be moulded in a long forme, and when they are taken out of the kilne be layed (as we ſayd of the iron) to coole north and ſouth, will haue the ſame effect wrought in them. And iron, though it hath not beene heated; but only hath cõtinued long vnmoued in the ſame ſituation of north and ſouth, in a building; yet it will haue the ſame effect. So as it can not be denyed, but that this vertue cometh vnto iron frõ other bodies: whereof one muſt be a ſecret influẽce from the north. And this is confirmed, by a loadeſtones looſing its vertue (as we ſaid before) by lying a long time vnduly diſpoſed, eyther towardes the earth, or towardes a ſtronger loadeſtone; whereby inſteed of the former, it gaineth a new vertue according to that ſituation.

And this happeneth, not only in the vertue which is reſident and permanent in a loadeſtone or a touched iron; but likewiſe, in the actuall motion or operation of them. As may be experienced; firſt, in this, that the ſame loadeſtone or touched irõ in the ſouth hemiſphere of the world hath its operatiõ ſtrongeſt att that end of it which tendeth to the north; and in the north hemiſphere, att the end which tẽdeth to the ſouth: each pole communicating a vigour proportionable to its owne ſtrẽgth in the climate where it is receiued. Secondly, in this, that an iron ioyned to a loadeſtone, or within the ſphere of the loadeſtones working, will take vp an other piece of iron greater then the loadeſtone of it ſelfe can hold; and as ſoone as the holding iron is remoued out of the ſphere of the loadeſtones actiuity, it preſently letteth fall the iron it formerly held vp: and this is ſo true; that a leſſer loadeſtone may be placed in ſuch ſort within the sphere of a greater loadeſtones operation, as to take away a piece of iron from the greater loadeſtone; and this, in vertue of the ſame greater loadeſtone from which it plucketh it: for, but remoue the leſſer out of the sphere of the greater; and then it can no longer do it. So that it is euident, that in theſe caſes, the very actuall operation of the leſſer loadeſtone or of the iron; proceedeth from the actuall influence of the greater loadeſtone vpon and into them. And hence we may vnderſtand, that whenſoeuer a Magnetike body doth worke, it hath an excitation from without, which doth make it iſſue out and ſend its ſtreames abroad; in ſuch ſort as it is the nature of all bodies to do; and as we haue giuen examples of the like done by heate, when we diſcourſed of Rarefaction.

But to explicate this point more clearely by entering more particularly into it; if a magnetike body lyeth north and ſouth, it is eaſy and obuious to conceiue that the ſtreames coming from north and ſouth of the

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world, and passing through the stone must needes excitate the vertue which is in it, and carry a streame of it along with them that way, they goe. But if it lyeth East and West, then the steames of north and south of the earth, streaming along by the two Poles of the stone, are sucked in by them much more weakely: yet neuertheleſſe sufficiently to giue an excitation to the innate steames which are in the body of the stone, to make them moue on in their ordinarie course.

4. The vertue of the loadestone is a double, and not one simple vertue.

The third position is, that the vertue of the loadestone is a double and not one simple vertue. Which is manifest in an iron touched by a loadestone, for if you touch it only with one pole of the stone, it will not be so strong and full of the magnetike vertue, as if you touch one end of it with one pole, and the other end of it with the other pole of the stone. Againe; if you touch both endes of an iron, with the same pole of the stone, the iron gaineth its vertue att that end which was last touched; and changeth its vertue from end to end, as often as it is rubbed att contrary endes. Againe; one end of the loadestone or of iron touched, will haue more force on the one side of the æquator, and the other end on the other side of it. Againe; the variation on the one side of the æquator, and the variation on the other side of it, haue different lawes according to the different endes of the loadestone, or of the needle, which looketh to those Poles.

Wherefore, it is euident, that there is a double vertue in the loadestone, the one more powerfull att the one end of it; the other more powerfull att the other end. Yet these two vertues are found in euery sensible part of the stone: for cutting it att eyther end, the vertue att the contrary end is also diminished. And the whole loadestone that is left, hath both the same vertues, in proportion to its biggnesse. Besides cutt the loadestone how you will, still the two poles remaine in that line, which lay vnder the meridian when it was in the earth. And the like is of the touched iron whose vertue still lyeth along the line, which goeth straight (according to the line of the axis) from the point where it was touched, and att the oppoſite end, constituteth the contrary pole.

5. The vettue of the loadestone worketh more strongly in the poles of it, then in any other part.

The fourth position is, that though the vertue of the loadestone be in the whole body; neuertheleſſe, its vertue is more seene in the poles then in any other partes. For by experience it is found that a loadestone of equall bulke, worketh better and more efficaciously if it be in a long forme; then if it be in any other. And from the middle line betwixt the two poles, there cometh no vertue, if an iron be touched there: but any part towardes the pole; the neerer it is to the pole, the greater vertue it imparteth. Lastly; the declination teacheth vs the same; which is so much the stronger by how much it is neerer the pole.

6. The loadestone sendeth forth its emanations spherically. Which are of two kindes: and each kind is strongest in that hemisphere, through whose polary partes they issue out.

The fift position is, that in the loadestone there are emanations which do issue not only att the poles and about them, but also spherically, round about the whole body, and in an orbe from all partes of the superficies of it; in such sort as happeneth in all other bodies whatsoeuer.

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whatsoeuer. And that these sphericall emanations, are of two kindes; proportionable to the two polar emanations. And that the greatest force of each sort of them is in that hemisphere where the pole is, att which they make their chiefe issue.

The reason of the first part of this position is, because no particular body can be exempt from the lawes of all bodies: and we haue aboue declared that euery physicall body must of necessity haue an orbe of fluours, or a sphere of actiuity about it. The reason of the second part is, that seeing these fluours do proceed out of the very substance and nature of the loadestone, they can not choose but be found of both sortes, in euery part how little soeuer it be, where the nature of the loadestone resideth. The reason of the third part is, that because the polar emanations do tend wholy towardes the poles (each of them to their proper pole) it followeth that in euery hemisphere both those which come from the contrary hemisphere, and those which are bred in the hemisphere they go out att, are all assembled in that hemisphere: and therefore, of necessity it must be stronger in that kind of fluours, then the opposite end is. All which appeareth true in experience: for if a long iron toucheth any part of that hemisphere of a loadestone which tendeth to the north; it gaineth att that end a vertue of tending likewise to the north: and the same will be if an iron but hang close ouer it. And this may be confirmed by a like experience, of an iron barre in respect of the earth which hãging downewardes in any part of our hemisphere, is imbued with the like inclination of drawing towardes the north.

7. Putting two loadestones within the sphere of one an other, euery part of one loadestone, doth not agree with euery part of the other loadestone.

The sixt position is, that although euery part of one loadestone do *in it selfe* agree with euery part of an other loadestone (that is, if each of these partes were diuided from their wholes, and each of them made a whole by it selfe, they might be so ioyned together as they would agree) neuertheless, when the partes are in their two wholes, they do not all of them agree together: but of two loadestones, only the poles of the one do agree with the whole body of the other; that is, each pole with any part of the contrary hemisphere of the other loadestone.

The reason of this is, because the fluours which issue out of the stones, are in certaine different degrees in seuerall partes of the entire loadestones; whereby it happeneth that one loadestone can worke by a determinate part of it selfe most powerfully vpon the other, if some determinate part of that other do lye next vnto it; and not so well, if any other part lyeth towardes it. And accordingly experience sheweth that if you putt the pole of a loadestone towardes the middle of a needle that is touched att the point, the middle part of the needle will turne away, and the end of it will conuert it selfe to the pole of the loadestone.

8. Cõcerning the declination and other respects of a needle, towardes the loadestone it toucheth.

The seuenth position is, that if a touched needle and a loadestone do come together, and touch one an other in their agreeing partes (whatsoeuer partes of them those be) the line of the needles length will

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bend towardes the pole of the ſtone (excepting, if they touch by the æquator of the ſtone, and the middle of the needle:) yet not ſo that if you draw out the line of the needles length, it will go through the pole of the ſtone; vnleſſe they touch by the end of the one, and the pole of the other. But if they touch by the æquator of the one and the middle of the other; then the needle will lye parallele to the axis of the ſtone.

And the reaſon of this is manifeſt, for in that caſe the two poles being equidiſtant to the needle they draw it equally; and by conſequence the needle muſt remaine parallele to the axis of the ſtone. Nor doth it import that the inequality of the two poles of the ſtone is materially or quantitatiuely greater then the inequality of the two poles of the needle; out of which it may att the firſt ſight ſeeme to follow, that the ſtronger pole of the ſtone should draw the weaker pole of the needle neerer vnto it ſelfe; then the weaker pole of the ſtone can be able to draw the ſtronger pole of the needle: and by conſequence that the needle should not lye parallele to the axis of the ſtone, but should incline ſomewhat to the ſtronger pole of it. For after you haue well conſidered the matter, you will find that the ſtrength of the pole of the ſtone, can not worke according to its materiall greatneſſe, but is confined to worke only according to the ſuſceptibility of the needle: the which, being a ſlender and thinne body, can not receiue ſo much as a thicker body may. Wherefore, ſeeing that the ſtrongeſt pole of the ſtone giueth moſt ſtrength to that pole of the needle, which lyeth furtheſt from it; it may well happen that this ſuperiority of ſtrength in the pole of the needle that is applyed to the weaker pole of the ſtone, may counterpoiſe the exceſſe of the ſtronger pole of the ſtone, ouer its oppoſite weaker pole; though not in greatneſſe and quantity, yet in reſpect of the vertue which is communicable to the poles of the needle; whereby its comportment to the poles of the ſtone, is determined. And indeed the needles lying parallele to the axis of the ſtone when the middle of it ſticketh to the æquator of the ſtone, conuinceth that vpon the whole matter, there is no exceſſe in the efficacious working of eyther of the ſtones poles: but that their exceſſe ouer one an other in regard of themſelues, is balanced by the needles receiuing it.

But if the needle happeneth to touch the loadeſtone in ſome part neerer one pole then the other; in this caſe it is manifeſt that the force of the ſtone is greater on the one ſide of the needles touch, then on the other ſide; becauſe there is a greater quantity of the ſtone on the one ſide of the needle then on the other: and by conſequence the needle will incline that way which the greater force draweth it; ſo farre forth as the other part doth not hinder it. Now we know that if the greater part were diuided from the reſt, and ſo were an entire loadeſtone by it ſelfe (that is, if the loadeſtone were cutt of where the needle toucheth it) then the needle would ioyne it ſelfe to the pole, that is to the end, of that part: and by conſequence, would be tending to it, in ſuch ſort as a thing

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that is ſucked tendeth towardes the ſucker againſt the motion or force which cometh from the leſſer part: and on the other ſide the leſſer part of the ſtone which is on the other ſide of the point which the needle toucheth, muſt hinder this inclination of the needle according to the proportion of its ſtrength; and ſo it followeth that the needle will hang by its end, not directly fett to the end of the greater part, but as much inclining towardes it as the leſſer part doth not hinder by ſtriuing to pull it the other way. Out of which we gather the true cauſe of the needles declination, to witt the proportion of working of the two vnequall partes of the ſtone, betweene which it toucheth and is ioyned to the ſtone.

9. The vertue of the loadeſtone goeth from end to end in lines almoſt parallele to the axis.

And we likewiſe diſcouer their errour who iudge that the part which draweth iron is the next pole vnto the iron. For it is rather the contrary pole which attracteth; or to ſpeake more properly it is the whole body of the ſtone as ſtreaming in lines almoſt parallele to the axis, from the furthermoſt end, to the other end which is next to the iron: and (in our caſe) it is that part of the ſtone which beginneth from the contrary pole and reacheth to the needle. For beſides the light which this diſcourſe gaue vs, experience aſſureth vs that a loadeſtone, whoſe poles lye broadwayes, not longwayes the ſtone, is more imperfect, and draweth more weakely then if the poles lay longwayes; which would not be if the fluours did ſtreame from all partes of the ſtone directly to the pole: for then, howſoeuer the ſtone were caſt the whole vertue of it would be in the poles. Moreouer, if a needle were drawne freely, vpon the ſame meridian frō one pole to the other; as ſoone as it were paſſed the æquator it would leape ſoddainely att the very firſt remooue off of the æquator, where it is parallele with the axis of the loadeſtone, from being ſo parallele, to make an angle with the axis greater then a halfe right one, to the end that it might looke vpon the pole which is ſuppoſed to be the only attractiue that draweth the needle: which great change, wrought all att once, nature neuer cauſeth nor admitteth, but in all actions or motions, vſeth to paſſe through all the mediums whenſoeuer it goeth from one extreme to an other. Beſides; there would be no variation of the needles aſpect towardes the north end of the ſtone: for if euery part did ſend its vertue immediately to the poles, it were impoſſible that any other part whatſoeuer ſhould be ſtronger then the polar part, ſeeing that the polar part, had the vertue euen of that particular part, and of all the other partes of the ſtone beſides, ioyned in it ſelfe.

This therefore is euident; that the vertue of the loadeſtone goeth from end to end in parallele lines; vnleſſe it be in ſuch ſtones as haue their polar partes narrower then the reſt of the body of the ſtone: for in them, the ſtreame will tend with ſome little declination towardes the pole, as it were by way of refraction; becauſe without the ſtone, the fluours from the pole of the earth do coarct themſelues, and ſo do thicken their ſtreame, to croude into the ſtone as ſoone as they are

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ſenſible of any emanations from it, that being (as we haue ſaid before) their readyeſt way to paſſe along: and within the ſtone, the ſtreame doth the like to meete the aduenient ſtreame where it is ſtrongeſt and thickeſt; which is, att that narrow part of the ſtones end, which is moſt prominent out.

10. The vertue of the loadeſtone is not perfectly ſpherical though the ſtone be ſuch.

And by this diſcourſe we diſcouer likewiſe an other errour of them, that imagine the loadeſtone hath a ſphere of actiuity round about it, equall on all ſides; that is, perfectly ſpherical, if the ſtone be ſpherical. Which cleerely is a miſtaken ſpeculation: for nature hauing ſo ordered all her agents that where the ſtrength is greateſt, there the action muſt (generally ſpeaking) extend it ſelfe furtheſt off; and it being acknowledged that the loadeſtone hath greateſt ſtrength in its poles and leaſt in the æquator; it muſt of neceſſity follow, that it worketh further by its poles then by its æquator. And conſequently, it is impoſſible that its ſphere of actiuity should be perfectly ſpherical.

Nor doth Cabeus his experience moue vs to conceiue the loadeſtone hath a greater ſtrength to retayne an iron layed vpon it by its æquator, then by its poles: for to iuſtify his aſſertion, he should haue tried it in an iron wyre that were ſo short, as the poles could not haue any notable operation vpon the endes of it; ſiince otherwiſe, the force of retayning it, will be attributed to the poles (according to what we haue aboue deliuered) and not to the æquator.

11. The intention of nature in all the operations of the loadeſtone, is to make an vnion betwixt the attractiue and attracted bodies.

The eighth poſition is; that the intention of nature in all the operations of the loadeſtone, is to make an vnion betwixt the attractiue and the attracted bodies. Which is euident out of the ſticking of them together: as alſo out of the violence wherewith iron cometh to a loadeſtone; which when it is drawne by a powerfull one, is ſo great, that through the force of the blow hitting the ſtone, it will rebound backe againe, and then fall againe to the ſtone: and in like manner a needle vpon a pinne, if a loadeſtone be ſett neere it, turneth with ſo great a force towardes the pole of the ſtone, that it goeth beyond it, and coming backe againe, the celerity wherewith it moueth maketh it retire it ſelfe too farre on the other ſide; and ſo by many vndulations, att the laſt it cometh to reſt directly oppoſite to the pole. Likewiſe, by the declination; by meanes of which, the iron to the ſtone, or the ſtone to the earth, approacheth in ſuch a diſpoſition as is moſt conuenient to ioyne the due endes together. And laſtly, out of the flying away of the contrary endes from one an other: which clearely is to no other purpoſe, but that the due endes may come together. And in generall; there is no doubt but ones going to an other, is inſtituted by the order of nature for their coming together, and for their being together, which is but a perſeuerance of their coming together.

12. The maine globe of the earth is not a loadeſtone.

The nineth poſition is, that the nature of a loadeſtone doth not ſinke deeply into the maine body of the earth, as to haue the ſubſtance of its whole body, be magneticall; but only remayneth neere the ſurface of it.

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of it. And this is euident by the inequality in vertue of the two endes; for if this magnetike vertue were the nature of the whole body, both endes would be equally ſtrong. Nor would the diſpoſition of one of the endes, be different from the diſpoſition of the other. Againe, there could be no variation of the tending towardes the north: for the bulke of the whole body would haue a ſtrength ſo eminently greater, then the prominences and diſparities of hils or ſeas; as the varieties of theſe would be abſolutely inſenſible. Againe; if the motion of the loadeſtone came from the body of the earth, it would be perpetually from the center, and not from the poles; and ſo, there could be no declination, more in one part of the earth, then in an other. Nor would the loadeſtone tend from north to ſouth, but from the center to the circumference; or rather from the circumference to the center.

And ſo we may learne the difference between the loadeſtone and the earth in their attractiue operations; to witt, that the earth doth not receiue its influence from an other body, nor doth its magnetike vertue depend of an other magnetike agent, that impreſſeth it into it: which neuertheleſſe, is the moſt remarkable condition of a loadeſtone. Againe the ſtrongeſt vertue of the loadeſtone, is from pole to pole: but the ſtrongeſt vertue of the earth, is from the center vpwardes, as appeareth by fireforkes gaining a much greater magnetike ſtrength in a short time, then a loadeſtone in a longer. Neyther can it be thence obiected, that the loadeſtone should therefore receiue the earthes influences more ſtrongly from the centerwardes, then from the poles of the earth, (which by its operation, and what we haue diſcourſed of it, is certaine it doth not;) ſince the beds where loadeſtones lye and are formed be towardes the bottome of that part or barke of the earth which is imbued with magnetike vertue. Againe, this vertue which we ſee in a loadeſtone, is ſubſtantiall to it; whereas the like vertue is but accidentall to the earth, by meanes of the ſunnes drawing the northerne and ſouththerne exhalations to the æquator.

13. The loadeſtone is generated in all partes or climats of the earth.

The laſt poſitiō is, that the loadeſtone muſt be found ouer all the earth, and in euery country. And ſo we ſee it is: both becauſe iron mines are found (in ſome meaſure) almoſt in all countries: and becauſe, att the leaſt other ſortes of earth (as we haue declared of pottearths) can not be wanting in any large extent of country; which when they are baked and cooled in due poſitions, haue this effect of the loadeſtone, and are of the nature of it. And Docteur Gilbert sheweth, that the loadeſtone is nothing elſe but the oore of ſteele or of perfecteſt iron; and that it is to be found of all colours, and fashions, and almoſt of all conſiſtences.

14. The conformity betwixt the two motiōs of magnetike thinges, and of heauy thinges.

So that we may eaſily conceiue, that the emanations of the loadeſtone being euery where, as well as the cauſes of grauity; the two motions of magnetike thinges and of weighty thinges, do both of them deriue their origine from the ſame ſource; I meane, from the very ſame emanations coming from the earth; which by a diuers ordination of nature, do make

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this effect in the loadestone, and that other in weighty thinges. And who knoweth but that a like sucking to this which we haue shewed in magnetike thinges, passeth also in the motion of grauity? In a wold; grauity beareth a faire testimony in the behalfe of the magnetike force; and the loadestones working, returneth no meane verdict for the causes of grauity, according to what we haue deliuered of them.

THE TWO AND TWENTIETH CHAPTER.

A solution of certaine Problemes concerning the loadestone, and as hort summe of the whole doctrine touching it.

1. Which is the North, and which the South Pole of a loadestone.

OVt of what is said vpon this subiect, we may proceed to the solution of certaine questions or problemes, which are or may be made in this matter. And first, of that which Doctour Gilbert disputeth against all former writers of the loadestone; to witt which is the North, and which the South pole of a stone? Which seemeth vnto me, to be only a question of the name: for if by the name of north and south, we vnderstād that end of the stone which hath that vertue that the north or south pole of the earth haue; then it is certaine, that the end of the stone which looketh to the south pole of the earth, is to be called the north pole of the loadestone; and contrariwise, that which looketh to the north, is to be called the south pole of it. But if by the names of north and south pole of the stone, you meane those endes of it, that lye and point to the north and to the south poles of the earth; then you must reckon their poles contrariwise to the former account. So that the termes being once defined, there will remaine no further controuersye about this point.

2. Whether any bodies besides magnetike ones be attractiue.

Doctor Gilbert seemeth also to haue an other controuersy with all writers; to witt whether any bodies besides magneticall ones, be attractiue? Which he seemeth to deny; all others to affirme. But this also being fairely putt, will peraduenture proue no controuersy: for the question is eyther in common, of attraction; or else in particular, of such an attraction as is made by the loadestone. Of the first part, there can be no doubt; as we haue declared aboue; and as is manifest betwixt gold and quickesiluer, when a man holding gold in his mouth, it draweth vnto it the quickesiluer that is in his body. But for the attractiue to draw a body vnto it selfe, not wholy, but one determinate part of the body drawne, vnto one determinate part of the drawer; is an attraction which for my part I can not exemplify in any other bodies but magneticall ones.

A third

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A third queſtion is, whether an iron that ſtandeth long time vnmoued in a window, or any other part of a building, perpendicularly to the earth, doth contract a magneticall vertue of drawing or pointing towardes the north in that end which looketh downewardes. For Cabeus (who wrote ſince Gilbert) affirmeth it out of experience: but eyther his experiment or his expreſſion was defectiue. For aſſuredly if the iron ſtandeth ſo, in the northerne hemiſphere, it will turne to the north; and if in the ſoutherne hemiſphere; it will turne to the ſouth: for ſeeing the vertue of the loadeſtone proceedeth from the earth, and that the earth hath different tempers towardes the north, and towardes the ſouth pole (as hath beene already declared) the vertue which cometh out of the earth in the northerne hemiſphere, will giue vnto the end of the iron next it an inclination to the north pole; and the earth of the ſoutherne hemiſphere will yield the contrary diſpoſition vnto the end which is neereſt it.

3. whether an iron placed perpẽdicularly towardes the earth doth gett a magneticall vertue of pointing towardes the north, or towardes the ſouth in that end that lyeth downewardes.

The next queſtion is, why a loadeſtone ſeemeth to loue iron better then it doth an other loadeſtone? The anſwere is, becauſe iron is indifferent in all its partes to receiue the impreſſion of a loadeſtone; whereas an other loadeſtone receiueth it only in a determinate part: and therefore a loadeſtone draweth iron more eaſily then it can an other loadeſtone; becauſe it findeth repugnance in the partes of an other loadeſtone, vnleſſe it be exactly ſituated in a right poſition. Beſides, iron ſeemeth to be compared to a loadeſtone, like as a more humide body to a dryer of the ſame nature; and the difference of male and female ſexes in animals do manifeſtly ſhew the great appetence of coniunction between moyſture and dryneſſe, when they belong to bodies of the ſame ſpecies.

4. why loadeſtones affect iron better then one an other.

An other queſtion, is that great one; why a loadeſtone capped with ſteele, taketh vp more iron then it would do if it were without that capping? An other concluſion like vnto this, is that if by a loadeſtone you take vp an iron, and by that iron a ſecond iron, and then you pull away the ſecond iron; the firſt iron (in ſome poſition) will leaue the loadeſtone to ſticke vnto the ſecond iron, as long as the ſecond iron is within the ſphere of the loadeſtones actiuity; but if you remoue the ſecond out of that ſphere, then the firſt iron remaining within it, though the other be out of it, will leaue the ſecond, and leape backe to the loadeſtone. To the ſame purpoſe, is this other concluſion; that the greater the iron is, which is entirely within the compaſſe of the loadeſtones vertue, the more ſtrongly the loadeſtone will be moued vnto it; and the more forcibly it will ſticke to it.

5. Gilberts reaſon refuted touching a capped loadeſtone, that taketh vp more iron then one not capped; and an iron impregnated that in ſome caſe draweth more ſtrongly then the ſtone it ſelfe.

The reaſons of all theſe three, wee muſt giue att once; for they hang all vpon one ſtring. And in my conceite neyther Gilbert nor Galileo haue hitt vpon the right. As for Gilbert; he thinketh that in iron there is originally the vertue of the loadeſtone; but that it is as it were a ſleepe vntill by the touch of the loadeſtone it be awaked and ſett on worke:

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and therefore the vertue of both ioyned together, is greater then the vertue of the loadeſtone alone.

But if this were the reaſon, the vertue of the iron would be greater in euery regard, and not only in ſticking or in taking vp: whereas himſelfe confeſſeth, that a capped ſtone draweth no further, then a naked ſtone, nor hardly ſo farre. Beſides, it would continue its vertue out of the ſphere of actiuity of the loadeſtone, which it doth not. Againe; ſeeing that if you compare them ſeuerally, the vertue of the loadeſtone is greater, then the vertue of the iron; why should not the middle iron ſticke cloſer to the ſtone then to the further iron which muſt of neceſſity haue leſſe vertue?

6. Galileus his opinion touching the former effects, refuted.

Galileo yieldeth the cauſe of this effect, that when an iron toucheth an iron, there are more partes which touch one an other, then when a loadeſtone toucheth the iron: both becauſe the loadeſtone, hath generally much impurity in it, and therefore diuers partes of it haue no vertue; whereas iron, by being melted hath all its partes pure: and ſecondly, becauſe iron can be ſmoothed and polisked more then a loadeſtone can be: and therefore its ſuperficies toucheth in a manner with all its partes; whereas diuers partes of the ſtones ſuperficies can not touch, by reaſon of its ruggednesſe.

And he confirmeth his opinion by experience: for if you putt the head of a needle to a bare ſtone, and the point of it to an iron; and then plucke away the iron; the needle will leaue the iron, and ſticke to the ſtone: but if you turne the needle the other way, it will leaue the ſtone and ſticke to the iron. Out of which he inferreth that it is the multitude of partes, which cauſeth the cloſe and ſtrong ſticking. And it ſeemeth he found the ſame in the capping of his loadeſtones: for he vſed flatt irons for that purpoſe; which by their whole plane did take vp other irons: whereas Gilbert capped his with cõuexe irons; which not applying themſelues to other iron, ſo ſtrongly or with ſo many partes as Galileos did, would not by much take vp ſo great weightes as his.

Neuertheleſſe, it ſeemeth not to me that his anſwere is ſufficient, or that his reaſons conuince; for we are to conſider that the vertue which he putteth in the iron muſt (according to his owne ſuppoſition) proceed from the loadeſtone: and then, what importeth it, whether the ſuperficies of the iron which toucheth an other iron, be ſo exactly plaine or no? Or that the partes of it be more ſolide then the partes of the ſtone? For all this conduceth nothing to make the vertue greater then it was: ſince no more vertue can go from one iron to the other, then goeth from the loadeſtone to the firſt iron: and if this vertue can not tye the firſt iron to the loadeſtone; it can not proceed out of this vertue that the ſecond iron be tyed to the firſt. Againe; if a paper be putt betwixt the cappe and an other iron, it doth not hinder the magneticall vertue from paſſing through it to the iron; but the vertue of taking vp more weight then the naked ſtone was able to do, is thereby rendered quite vſeleſſe.

Therefore

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Therefore it is euident, that this vertue muſt be putt in ſomething elſe, and not in the application of the magneticall vertue.

And to examine his reaſons particularly, it may very well fall out that whatſoeuer the cauſe be, the point of a needle may be too little to make an exact experience in; and therefore a new doctrine ought not lightly be grounded vpon what appeareth in the application of that. And likewiſe, the greatneſſe of the ſurfaces of the two irons, may be a condition helpefull to the cauſe whatſoeuer it be: for greater and leſſer, are the common conditions of all bodies, and therefore do auayle all kindes of corporeall cauſes; ſo that, no one cauſe can be affirmed more then an other, meerely out of this that great doth more, and little doth leſſe.

7. The Authors ſolution to the former queſtions.

To come then to our owne ſolution: I haue conſidered, how fire hath in a manner the ſame effect in iron, as the vertue of the loadeſtone hath by meanes of the cappe: for I find that fire coming through iron red glowing hoat, will burne more ſtrongly, then if it ſhould come immediately through the ayre; as alſo we ſee that in pittecoale the fire is ſtronger then in charcoale. And neuertheleſſe, the fire will heat further if it come immediately from the ſource of it, then if it come through a red iron that burneth more violently where it toucheth; and likewiſe charcoale will heat further then pittcoale, that neere hand burneth more fiercely. In the ſame manner, the loadeſtone will draw further without a cappe then with one; but with a cappe it ſticketh faſter then without one. Whence I ſee that it is not purely the vertue of the loadeſtone; but the vertue of it being in iron; which cauſeth this effect.

Now this modification, may proceed eyther from the multitude of partes which come out of the loadeſtone, and are as it were ſtopped in the iron; and ſo the ſphere of their actiuity becometh shorter but ſtronger: or elſe from ſome quality of the iron ioyned to the influence of the loadeſtone. The firſt ſeemeth not to giue a good account of the effect; for why ſhould a little paper take it away, ſeeing we are ſure that it ſtoppeth not the paſſage of the loadeſtones influence? Againe; the influence of the loadeſtone, ſeemeth in its motion to be of the nature of light, which goeth in an inſenſible time as farre as it can reach: and therefore, were it multiplyed in the iron, it would reach further then without it; and from it, the vertue of the loadeſtone would beginne a new ſphere of actiuity. Therefore, we more willingly cleaue to the latter part of our determination.

And there vpon enquiring what quality there is in iron, whence this effect may follow; we find that it is diſtinguished from a loadeſtone, as a mettall is from a ſtone. Now we know that mettalls haue generally more humidity then ſtones; and we haue diſcourſed aboue, that humidity is the cauſe of ſticking: eſpecially when it is little and denſe. Theſe qualities muſt needes be in the humidity of iron: which of all

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mettalls is the moſt terreſtriall : and ſuch humidity as is able to ſticke to the influence of the loadeſtone, as it paſſeth through, the body of the iron, muſt be exceeding ſubtile and ſmall; and it ſeemeth neceſſary that ſuch humidity should ſticke to the influence of the loadeſtone, when it meeteth with it, conſidering that the influence is of it ſelfe dry and that the nature of iron is akinne to the loadeſtone : wherefore, the humidity of the one, and the drought of the other, will not faile of incorporating together. Now then, if two irons, well polished and plaine, be vnited by ſuch a glew as reſulteth out of this compoſition, there is a manifeſt appearance of much reaſon for them to ſticke ſtrongly together. This is confirmed by the nature of iron in very cold countries and very cold weather: for the very humidity of the ayre in times of froſt, will make vpon iron, ſooner then vpon other thinges, ſuch a ſticking glew as will pull off the skinne of a mans hand that toucheth it hard.

And by this diſcourſe, you will perceiue that Galileos arguments do confirme our opinion as well as his owne; and that according to our doctrine, all circumſtances muſt fall out iuſt as they do in his experiences. And the reaſon is cleare why the interpoſition of an other body, hindereth the ſtrong ſticking of iron to the cappe of the loade-ſtone; for it maketh the mediation between them greater, which we haue shewed to be the generall reaſon why thinges are eaſily parted.

Lett vs then proceed to the reſolution of the other caſes propoſed. The ſecond is already reſolued: for if this glew be made of the influence of the loadeſtone, it can not haue force further then the loadeſtone it ſelfe hath: and ſo farre, it muſt haue more force, then the bare influence of the loadeſtone. Or rather the humidity of two irons maketh the glew of a fitter temper to hold, then that which is betweene a dry loadeſtone and iron; and the glew entereth better when both ſides are moiſt, then when only one is ſo.

8. The reaſō why in the former caſe, a leſſer loadeſtone doth draw the interiacent irō frō the greater.

But this reſolution though it be in part good, yet it doth not euacuate the whole difficulty, ſince the ſame caſe happeneth betweene a ſtronger and a weaker loadeſtone, as betweene a loadeſtone and iron: for the weaker loadeſtone, whilſt it is, within the ſphere of actiuity of the greater loadeſtone, draweth away an iron ſett betwixt them as well as a ſecond iron doth. For the reaſon therefore of the little loadeſtones drawing away the iron, we may conſider that the greater loadeſtone hath two effects vpon the iron, which is betwixt it and a leſſer loadeſtone, and a third effect vpon the little loadeſtone it ſelfe. The firſt is that it impregnateth the iron, and giueth it a permanent vertue by which it worketh like a weake loadeſtone. The ſecond is, that as it maketh the iron worke towardes the leſſer loadeſtone by its permanent vertue; ſo alſo it accompanyeth the ſteame that goeth from the iron towardes the little loadeſtone with its owne ſteame, which goeth the ſame way: ſo that both theſe ſteames do in company clymbe vp the ſteame of the little loadeſtone which meeteth them; and that ſteame clymbeth

clymbeth vp the enlarged one of both theirs together. The third effect which the greater loadeſtone worketh, is that it maketh the ſteame of the little loadeſtone become ſtronger by augmenting its innate vertue in ſome degree.

Now then, the going of the iron to eyther of the loadeſtones, muſt follow the greater and quicker coniunction of the two meeting ſteames, and not the greatneſſe of one alone. So that if the coniunction of the two ſteames between the iron and the little loadeſtone be greater and quicker then the coniunction of the two ſteames which meete between the greater loadeſtone and the iron, the iron muſt ſticke to the leſſer loadeſtone. And this muſt happen more often then otherwiſe: for the ſteame which goeth from the iron to the greater loadeſtone will for the moſt part be leſſe then the ſteame which goeth from the leſſer loadeſtone to the iron. And though the other ſteame be neuer ſo great yet it can not draw more then according to the proportion of its Antagoniſts coming from the iron. Wherefore ſeeing the two ſteames betwixt the iron and the little loadeſtone, are more proportionable to one an other, and the ſteame coming out of the little loadeſtone is notably greater, then the ſteame going from the iron to the greater loadeſtone; the coniunction muſt be made for the moſt part to the little loadeſtone. And if this diſcourſe doth not hold in the former part of the Probleme betwixt a ſecond iron and a loadeſtone, it is ſupplyed by the former reaſon which we gaue for that particular purpoſe.

The third caſe dependeth alſo of this ſolution; for the bigger an iron is, ſo many more partes it hath to ſucke vp the influence of the loadeſtone; and conſequently, doth it thereby the more greedily: and therefore the loadeſtone muſt be carried to it more violently, and when they are ioyned, ſticke more ſtrongly.

9. Why the variation of a touched needle frō the north, is greater, the neeter you go to the Pole.

The ſixt queſtion is, why the variations of the needle from the true north, in the northerne hemiſphere, are greater, the neerer you go to the Pole, and leſſer the neerer you approach to the Æquator. The reaſon whereof is plaine in our doctrine; for, conſidering that the magnetike vertue of the earth, ſtreameth from the north towardes the æquator; it followeth of neceſſity, that if there be two ſtreames of magnetike fluours iſſuing from the north, one of them, preciſely from the pole, and the other from a part of the earth neere the pole; and that the ſtreame coming from the point by ſide the pole, be but a little the ſtronger of the two; there will appeare very little differencies in their ſeuerall operations, after they haue had a long ſpace to mingle their emanations together; which thereby do ioyne, and grow as it were into one ſtreame. Whereas the neerer you come to the pole, the more you will find them ſeuered, and each of them working by its owne vertue. And very neere the point which cauſeth the variation, each ſtreame worketh ſingly by it ſelfe; and therefore here, the point of variation muſt be maſter, and will

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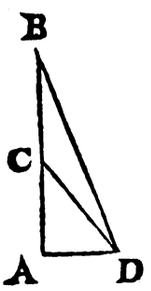
carry the needle ſtrongly vnto his courſe from the due north, if his ſtreame be neuer ſo little more efficacious then the other.

Againe; a line drawne from a point of the earth wyde of the pole, to a point of the meridian neere the æquator, maketh a leſſe angle, then a line drawne from the ſame point of the earth to a point of the ſame meridian neerer the pole: wherefore, the variation being eſteemed by the quantities of the ſaid angles, it muſt needes be greater neere the pole, then neere the æquator, though the cauſe be the ſame.

Which a little figure will preſently explicate. Lett the point A, be the pole; and the line A B, the meridian; and the point B, the interſection of it, with a parallele neere the æquator; and the point C, the interſection of the meridian with the Tropike; and D, a point in the earth neere the pole, vnto which in the ſaid interſection the needle tendeth, in ſteed of looking directly to the pole, whereby it maketh variation from due north. I ſay then, thar the variation of a needle neere the æquator in the point B, looking vpon the point D; can not be ſo great and ſenſible, as the variation of a needle in the Tropike C, looking vpon the ſame point; ſince the angle D B A, which is made by the variation of the firſt, is leſſe then the angle D C A, which is made by the variation of the latter needle, neerer the pole.



But becauſe it may happen, that in the partes neere the æquator, the variation may proceed from ſome piece of land, not much more northerly then where the needle is; but that beareth rather eaſterly or weſterly from it; and yet Gilberts aſſertion goeth vniuerſally, when he ſayth the variations in ſoutherne regions are leſſe, then in northerne ones: we muſt examine what may be the reaſon thereof. And preſently the generation of the loadeſtone sheweth it plainely: for ſeeing the nature of the loadeſtone proceedeth out of this, that the ſunne worketh more vpon the torride zone, then vpon the poles; and that his too ſtrong operation, is contrary to the loadeſtone, as being of the nature of fire; it followeth euidently that the landes of the torride zone can not be ſo magneticall (generally ſpeaking) as the polar landes are; and by conſequence that a leſſer land neere the pole, will haue a greater effect, then a larger continent neere the æquator: and likewiſe a land further off towardes the pole, will worke more ſtrongly then a neerer land which lyeth towardes the æquator.

10. Whether in the ſame part of the world a touched needle may att one time vary more frō the north, and att an other time leſſe.

The ſeuenth queſtion is, whether in the ſame part of the world a touched needle may att one time vary more from the true north point, and att an other time leſſe? In which Gilbert was reſolute for the negatiue part: but our latter Mathematiciens are of an other mind. Three experiences were made neere London in three diuers yeares. The two firſt, 42 yeares diſtant from one an other; and the third 12 yeares diſtant from the ſecond. And by them it is found that in the ſpace of 54 yeares,

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he loadeſtone hath att London diminished his variation from the north, the quantity of 7 degrees and more. But ſo that in the latter yeares the diminution hath ſenſibly gone faſter then in the former.

Theſe obſeruations peraduenture are but little credited by ſtrangers; but we who know the worth of the men that made them, can not miſtruſt any notable errour in them: for they were very able mathematicians, and they made their obſeruations with very greate exactneſſe; and there were ſeuerall iuditious wittneſſes att the making of them; as may be ſeene in Mr. Gillebrand his print concerning this ſubiect. And diuers other particular perſons do confirme the ſame; whoſe creditt, though each ſingle might peraduenture be ſlighted, yet all in body make a great acceſſion.

We muſt therefore caſt about to find what may be the cauſe of an effect ſo paradoxe to the reſt of the doctrine of the loadeſtone: for ſeeing that no one place, can ſtand otherwiſe to the north of the earth att one time then att an other; how is it poſſible that the needle should receiue any new variation, ſince all variation proceedeth out of the inequality of the earth? But when we conſider that this effect proceedeth not out of the maine body of the earth; but only out of the barke of it; and that its barke, may haue diuers tempers not as yet diſcouered vnto vs; and that out of the variety of theſe tempers, the influence of the earthy partes may be diuers in reſpect of one certaine place; it is not impoſſible but that ſuch variation may be; eſpecially in England: which Iland lying open to the north, by a great and vaſt ocean; may receiue more particularly then other places, the ſpeciall influences and variation of the weather, that happen in thoſe northeaſterne countries from whence this influence cometh vnto vs. If therefore there ſhould be any courſe of weather, whoſe periode were a hundred yeares (for example) or more or leſſe, and ſo might eaſily paſſe vnmarked; this variation might grow out of ſuch a courſe.

But in ſo obſcure a thing, we haue already hazarded to gueſſe too much. And vpon the whole matter of the loadeſtone, it ſerueth our turne, if we haue proued (as we conceiue we haue done fully) that its motions which appeare ſo admirable, do not proceed from an occult quality; but that the cauſes of them may be reduced vnto locall motion; and that all they may be performed by ſuch corporeall inſtruments and meanes (though peraduenture more intricately diſpoſed) as all other effects are among bodies. Whoſe ordering and diſpoſing and particular progreſſe, there is no reaſon to deſpaire of finding out; would but men carefully apply themſelues to that worke, vpon ſolide principles and with diligent experiences.

But becauſe this matter hath beene very long, and ſcatteringly diffuſed in many ſeuerall branches; peraduenture it will not be diſpleaſing to the Reader to ſee the whole nature of the loadeſtone ſummed vp in short. Lett him then caſt his eyes vpon one effect of it, that is very eaſy to

II. The whole doctrine of the loadeſtone ſummed vp in short.

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be tryed and is acknowledged by all writers; though we haue not as yet mentioned it. And it is, that a knife drawne from the pole of a loadestone towardes the equator, if you hold the point towardes the pole, it gaineth a respect to one of the poles: but contrawise, if the point of the knife be held towardes the æquator, and be thrust the same way it was drawne before (that is, towardes the æquator) it gaineth a respect towardes the contrary pole.

It is euident out of this experience, that the vertue of the loadestone is communicated by way of streames; and that in it, there are two cnntrary streames: for otherwise the motion of the knife this way or that way, could not change the efficacity of the same partes of the loadestone. It is likewise euident, that these contrary streames, do come from the conrrary endes of the loadestone. As also, that the vertues, of them both, are in euery part of the stone. Likewise that one loadestone, must of necessity turne certaine partes of it selfe, to certaine partes of an other loadestone; nay that it must goe and ioyne to it, according to the lawes of attraction which we haue aboue deliuered: and consequently that they must turne their disagreeing partes away from one an other; and so, one loadestone seeme to fly from an other, if they be so applyed that their disagreeing partes be kept still next to one an other: for in this case, the disagreeing and the agreeing partes of the same loadestone, being in the same straight line; one loadestone seeking to draw his agreeing part neere to that part of the other loadestone which agreeth with him, must of necessity turne away his disagreeing partes to giue way vnto his agreeing part to approach neerer.

And thus you see that the flying from one an other of two endes of two loadestones, which are both of the same denomination (as for example the two south endes, or the two north endes) doth not proceed from a pretended antipathy between those two endes, but from the attraction of the agreeing endes.

Furthermore, the earth, hauing to a loadestone the nature of a loadestone; it followeth that a loadestone must necessarily turne it selfe to the poles of the earth by the same lawes. And consequently, must tend to the north, must vary from the north, must incline towardes the center, and must be affected with all such accidents as we haue deduced of the loadestone.

And lastly; seeing that iron is to a loadestone, a fitt matter for it to impresse its nature in, and easily retaineth that magnetike vertue; the same effects that follow betweē two loadestones, must necessarily follow between a loadestone, and a peece of iron fittly proportionated in their degrees: excepting some litle particularities, which proceed out of the naturalnesse of the magnetike vertue to a loadestone, more then to iron.

And thus you see the nature of the loadestone summed vp in grosse; the particular ioyntes and causes whereof, you may find treated att large in the maine discourse. Wherein we haue gouerned our selues chiefely

chiefely by the experiences that are recorded by Gilbert and Cabeus; to whom, we remitt our reader for a more ample declaration of particulars.

THE THREE AND TWENTIETH CHAPTER.

A description of the two sortes of liuing creatures; Plants, and Animals: and how they are framed in common to performe vitall motion.

HItherto we haue endeauoured to follow by a continuall thridde, all such effects as we haue mett with among bodies, and to trace thē in all their windinges, and to driue them vp to their very roote and originall source: for the nature of our subiect hauing beene yet very common, hath not exceeded the compasse and power of our search and enquiry, to descend vnto the chiefe circumstances and particulars belonging vnto it. And indeede, many of the conueyances whereby the operations we haue discoursed of, are performed, be so secret and abstruse, as they that looke into them with lesse heedefullnesse and iudgment then such a matter requireth, are too apt to impute them to mysterious causes aboue the reach of humane nature to comprehēd, and to calumniate them of being wrought by occult and specifike qualities; whereof no more reason could be giuen, then if the effects were infused by Angelicall handes without assistance of inferiour bodies: which vseth to be the last refuge of ignorant men, who not knowing what to say, and yet presuming to say something, do fall often vpon such expressiōs, as neyther themselues nor their hearers vnderstand; and that if they be well scanned, do imply contradictions Therefore we deemed it a kind of necessity to straine ourselues to prosecute most of such effects, euen to their notionall connexions with rarity and density. And the rather becausse it hath not been our lucke yet to meet with any that hath had the like designe, or hath done any considerable matter to ease our paines. Which can not but make the readers iourney somewhat tedious vnto him to follow all our stepps, by reason of the ruggednesse, and vntrodenesse of the pathes we haue walked in. 1. The connexion of the following Chapters with the precedent ones.

But now the effects we shall hence forward meedle withall, do grow so particular, and do swarme into such a vast multitude of seuerall little ioyntes, and wreathy labyrinthes of nature, as were impossible in so summary a treatise, as we intend, to deliuer the causes of euery one of them exactly; which would require, both large discourses and abundance of experiences to acquitt our selues as we ought of such a taske. Nor is there a like neede of doing it as formerly, for as much as concerneth our designe; since the causes of them are palpably materiall, and the admirable artifice of them, consisteth only in the Dædalean and wunderfull ingenious ordering and ranging them one with an other.

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We shall therefore entreat our Reader from this time forwardes to expect only the common sequele of those particular effects, out of the principles already layed. And when some shall occurre, that may peraduenture seeme att the first sight to be enacted immediately by a vertue spirituall, and that proceedeth indiuisibly, in a different straine from the ordinary processes which we see in bodies and in bodily thinges (that is by the vertues of rarity and density, working by locall motion) we hope he will be satisfyed att our handes, if we lay downe a methode, and trace out a course, whereby such euents and operations may follow out of the principles we haue layed. Though peraduenture we shall not absolutely conuince that euery effect is done iust as we sett it downe in euery particular, and that it may not as well be done by some other disposing of partes, vnder the same generall scope: for it is enough for our turne if we shew that such effects may be performed by corporeall agents, working as other bodies do; without confining ourselues to an exactnesse in euery linke of the long chaine that must be wound vp in the performance of them.

2. Concerning seuerall cõpositions of mixed bodies.

To come then to the matter; the next thing we are to employ ourselues about, now that we haue explicated the natures of those motions by meanes whereof bodies are made and destroyed; and in which they are to be considered chiefely as passiue, whiles some exteriour agent working vpon them causeth such alterations in them, and bringeth them to such passe as wee see in the changes that are dayly wrought among substances; is, to take a suruay of those motions which some bodies haue, wherein they seeme to be not so much patients as agents; and do containe with in themselues the principle of their owne motion; and haue no relation to any outward obiect, more then to stirre vp that principle of motion, and sett it on worke: which when it is once in act, hath as it were within the limits of its owne kingdome, and seuered from commerce with all other bodies whatsoeuer, many other subalterne motions ouer which it presideth.

To which purpose we may consider that among the compounded bodies whose natures we haue explicated; there are some, in whom the partes of different complexions are so small and so well mingled together, that they make a compound, which to our sense seemeth to be all of it quite through, of one homogeneous nature; and howsoeuer it be diuided, each part retaineth the entire and cõplete nature of the whole. Others againe there are, in which it is easy to discerne that the whole is made vp of seuerall great partes of very differing natures and tẽpers.

And of these, there are two kindes: the one, of such, as their differing partes seeme to haue no relation to one an other, or correspondence together to performe any particular worke, in which all of them are necessary; but rather they seeme to be made what they are, by chance and by accident; and if one part be seuered from an other, each is an entire thing by it selfe, of the same nature as it was in the whole; and no harmony

harmony is destroyed by such diuision. As may be obserued in some bodies digged out of mines, in which one may see lūpes of mettall, oore, stone, and glasse, and such different substances, in their seuerall distinct situations, perfectly compacted into one continuate body; which if you diuide, the glasse remaineth what it was before, the Emerald is still an Emerald, the syluer is good syluer, and the like of the other substāces: the causes of which, may be easily deduced out of what we haue formerly said. But there are other bodies in which this manifest and notable difference of partes, carrieth with it such a subordinatiō of one of them vnto an other; as we can not doubt but that nature made such engines (if so I may call them) by designe; and intended that this variety should be in one thing; whose vnity and being what it is, should depend of the harmony of the seuerall differing partes, and should be destroyed by their seperation. As we see in liuing creatures; whose particular partes and members being once seuered there is no longer a liuing creature to be found among them.

3. Two sortes of liuing creatures.

Now of this kind of bodies, there are two sortes. The first is of those that seeme to be one continuate substance, wherein we may obserue one and the same constant progresse throughout, from the lowest vnto the highest part of it; so that, the operation of one part is not att all different from that of an other: but the whole body seemeth to be the course and throughfare of one constant action, varying it selfe in diuers occasions, and occurrences, according to the disposition of the subiect.

The bodies of the secōd sort, haue their partes so notably seperated one frō the other; and each of them haue such a peculiar motion proper vnto them, that one might conceiue they were euety one of them a complete distinct totall thing by it selfe, and that all of them were artificially tyed together; were it not, that the subordination of these partes to one an other is so great, and the correspondence betweene them so strict, (the one not being able to subsist without the other, from whom he deriueth what is needefull for him; and againe being so vsefull vnto that other and hauing its action and motion so fitting and necessary for it, as without it that other can not be;) as plainely conuinceth that the compound of all these senerall partes must needes be one indiuiduall thing.

4. An engine to expresse the first sort of liuing creatures.

I remember that when I trauailed in spaine, I saw there two engines that in some sort do expresse the natures of these two kindes of bodies. The one att Toledo, the other att Segouia: both of them sett on worke by the current of the riuer, in which the foundation of their machine was layed. That att Toledo, was to force vp water a great hieght from the riuer Tagus to the Alcazar (the King his pallace) that standeth vpon a high steepe hill or rocke, almost perpendicular ouer the riuer. In the bottome, there was an indented wheele, which turning round with the streame, gaue motion att the same time to the whole engine: which consisted of a multitude

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of little troughes or ſquare ladles ſett one ouer an other, in two parallele rowes ouer againſt one an other, from the bottome to the toppe, and vpon two ſeuerall diuided frames of tymber. Theſe troughes were cloſed att one end with a trauerſe bord to retaine the water from running out there; which end being bigger then the reſt of the trough, made it ſomewhat like a ladle: and the reſt of it, ſeemed to be the handle with a channell in it, the little end of which channell or trough was open to lett the water paſſe freely away. And theſe troughes were faſtened by an axeltree in the middle of them, to the frame of tymber that went from the bottome vp to the toppe: ſo that they could vpon that center moue att liberty eyther the shutt end downewardes, or the open end; like the beame of a ballance.

Now att a certaine poſition of the roote wheele (if ſo I may call it) all one ſide of the machine ſunke downe a little lower towardes the water, and the other was raiſed a little higher. Which motion was changed, as ſoone as the ground wheele had ended the remnant of his reuolution: for then, the ſide that was loweſt before, ſprung vp, and the other ſunke downe. And thus, the two ſides of the machine, were like two legges that by turnes trode the water; as in the vintage, men preſſe grapes in a watte. Now the troughes that were faſtened to the tymber which deſcended, turned that part of them downewardes which was like a boxe shutt to hold the water: and conſequently, the open end was vp in the ayre, like the arme of the ballance vnto which the lighteſt ſcale is faſtened: and in the meane time, the troughes vpon the aſcēding timber, were moued by a contrary motion; keeping their boxe endes aloft, and letting the open endes incline downewardes: ſo that if any water were in them, it would lett it runne out; whereas the others retained any that came into them.

When you haue made an image of this machine in your fantaſie, cōſider what will follow out of its motion. You will perceiue that when one legge ſinketh downe towardes the water, that trough which is next to the ſuperficies of it, putting downe his boxe end, and dipping it a little in the water; muſt needes bring vp as much as it can retaine, when that legge aſcendeth: which when it is att its height, the trough moueth vpon his owne center; and the boxe end, which was loweſt, becometh now higheſt, and ſo the water runneth out of it. Now the other legge deſcending att the ſame time; it falleth out that the trough on its ſide, which would be a ſteppe aboue that which hath the water in it, if they ſtood in equilibrity, becometh now a ſteppe lower then it: and is ſo placed, that the water which runneth out of that which is aloft, falleth into the head or boxe of it; which no ſooner hath receiued it, but that legge on which it is faſtened, ſpringeth vp, and the other deſcendeth: ſo that the water of the ſecond legge, runneth now into the boxe of the firſt legge, that is next aboue that which firſt laded the water out of the riuer. And thus, the troughes of the two legges deliuer their water by

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turnes from one ſide to the other; and att euery remooue, itgetteth a ſteppe vpwardes, till it cometh to the toppe; whiles att euery aſcent and deſcent of the whole ſide, the loweſt ladle or trough taketh new water from the riuer; which ladefull followeth immediately in its aſcent, that which was taken vp the time before. And thus, in a little while, all the troughes from the bottome to the toppe are full; vnleſſe there happen to be ſome failing in ſome ladle: and in that caſe the water breaketh out there; and all the ladles aboue that, are dry.

5. An other engine by which may be expreſſed the ſecond ſort of liuing creatures.

The other engine, or rather multitude of ſeuerall engines, to performe ſundry different operations, all conducing to one worke (whereas, that of Toledo, is but one tenour of motion, from the firſt to the laſt;) is in the minte at Segouia. Which is ſo artificially made, that one part of it, diſtendeth an ingott of ſiluer or gold into that breadth and thickneſſe as is requiſite to make coyne of. Which being done, it deliuereth the plate it hath wrought, vnto an other that printeth the figure of the coyne vpon it. And from thence it is turned ouer to an other that cutteth it according to the print, into due shape and weight. And laſtly, the ſeuerall peeces fall into a reſerue, in an other roome: where the officer, whoſe charge it is, findeth treaſure ready coyned; without any thing there, to informe him of the ſeuerall different motions that the ſiluer or the gold paſſed before they came to that ſtate. But if he goe on the other ſide of the wall, into the roome where the other machines ſtand and are att worke, he will then diſcerne that euery one of them, which conſidered by it ſelfe might ſeeme a diſtinct complete engine, is but a ſeruing part of the whole; whoſe office is, to make money: and that for this worke, any one of them ſeperated from the reſt, ceaſeth to be the part of a minte, and the whole is maymed and deſtroyed.

6. The two former engines and ſome other compariſons applyed to expreſſe the two ſeuerall ſortes of liuing creatures.

Now lett vs apply the conſideration of theſe different kindes of engines, to the natures of the bodies we treate of. Which I doubt not, would fitt much better, were they liuely and exactly deſcribed. But it is ſo long ſince I ſaw them, and I was then ſo very young, that I retaine but a confuſed and clowdy remembrance of them: eſpecially of the minte att Segouia, in the which there are many more particulars then I haue touched; as conueniency for refining the oore or mertall; and then caſting it into ingots; and driuing them into roddes; and ſuch like: vnto all which, there is little helpe of handes requiſite, more then to apply the matter duly att the firſt. But what I haue ſaid of them, is enough to illuſtrate what I ayme att: and though I ſhould erre in the particulars, it is no great matter; for I intend not to deliuer the hiſtory of them: but only out of the remembrance of ſuch note full and artificiall Maſterpeeces, to frame a modell in their fancies that ſhall reade this, of ſomething like them; whereby they may with more eaſe, make a right conception of what we are handling.

Thus then all ſortes of plants, both great and ſmall, may be compared to our firſt engine of the waterworke att Toledo, for in them, all the

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motion we can diſcerne, is of one part tranſmitting vnto the next to it, the iuice which it receiued from that immediately before it: ſo that it hath one conſtant courſe from the roote (which ſucketh it from the earth) vnto the toppe of the higheſt ſprigge: in which, if it should be intercepted and ſtopped by any mayming of the barke (the channell it aſcendeth by) it would there breake out and turne into droppes, or gumme, or ſome ſuch other ſubſtance as the nature of the plant requireth: and all that part of it vnto which none of this iuice can aſcend would drye and wither and grow dead.

But ſenſible liuing creatures, we may fitly compare to the ſecond machine of the minte att Segouia. For in them, though euery part and member, be as it were a complete thing of it ſelfe, yet euery one, requireth to be directed and putt on in its motion by an other; and they muſt all of them (though of very different natures and kindes of motion) conſpire together to effect any thing that may be, for the vſe and ſeruice of the whole. And thus we find in them perfectly the nature of a mouer and a moueable; each of them mouing differently from one an other, and framing to themſelues their owne motions, in ſuch ſort as is moſt agreeable to their nature, when that part which ſetteth them on worke hath ſtirred them vp.

And now becauſe theſe partes (the mouers, and the moued) are partes of one whole; we call the entire thing *Automatum* or *ſe mouens*; or a liuing creature. Which alſo may be fitly compared to a ioyner, or a painter, or other crafteſman, that had his tooles ſo exactly fitted about him, as when he had occaſion to do any thing in his trade, his toole for that action were already in the fitteſt poſitiō for it, to be made vſe of: ſo as without remouing himſelfe frō the place where he might ſitt enuironed with his tooles, he might, by only pulling of ſome little chordes, eyther apply the matter to any remote toole, or any of his tooles to the matter he would worke vpon, according as he findeth the one or the other more conuenient for performance of the action he intendeth.

Whereas in the other, there is no variety of motions; but one and the ſame, goeth quite through the body frō one end of it to the other. And the paſſage of the moyſture through it, from one part to an other next (which is all the motion it hath) is in a manner but like the riſing of water in a ſtille, which by heate is made to creepe vp by the ſides of the glaſſe; and from thence runneth through the noſe of the limbeke, and falleth into the receiuer. So that, if we will ſay that a plant liueth, or that the whole moueth it ſelfe, and euery part moueth other; it is to be vnderſtood in a farre more imperfect manner, then when we ſpeake of an animall: and the ſame wordes are attributed to both, in a kind of æquiuocall ſenſe. But by the way I muſt note, that vnder the title of plants I include not zoophytes or plantanimals: that is ſuch creatures as though they goe not from place to place, and ſo cauſe a locall motion of their whole ſubſtance, yet in their partes, they haue a diſtinct and articulate motion.

But to

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But to leaue compariſons, and come to the proper nature of the thinges: lett vs frame a conception, that not farre vnder the ſuperficies of the earth, there were gathered together diuers partes of little mixed bodies, which in the whole ſumme were yet but little: and that this little maſſe had ſome exceſſe of fire in it, ſuch as we ſee in wett hay, or in muſte of wine, or in woort of beere: and that withall the drought of it were in ſo high a degree, as this heate should not find meanes (being too much compreſſed) to play his game: and that, lying there in the boſome of the earth, it should after ſome little time receiue its expected and deſired drinke through the beneuolence of the heauen; by which it being moyſtened, and thereby made more pliable, and tender and eaſy to be wrought vpon, the little partes of fire should breake looſe; and they finding this moyſture a fitt ſubiect to worke vpon, should driue it into all the partes of the little maſſe, and digeſting it there should make the maſſe ſwell. Which action, taking vp long time for performance of it, in reſpect of the ſmall encreaſe of bulke made in the maſſe by the ſwelling of it; could not be hindered by the preſſing of the earth, though lying neuer ſo weightily vpon it: according to the maxime we haue aboue deliuered, that any little force, be it neuer ſo little; is able to ouercome any great reſiſtance, be it neuer ſo powerfull; if the force do multiply the time it worketh in, ſufficiently to equaliſe the proportions of the agent and the reſiſtant. This encreaſe of bulke and ſwelling of the litle maſſe, will of its owne nature be towardes all ſides, by reaſon of the fire and heate that occaſioneth it (whoſe motion is on euery ſide, from the center to the circumference:) but it will be moſt efficacious vpwardes, towardes the ayre, becauſe the reſiſtance is leaſt that way; both by reaſon of the litle thickneſſe of the earth ouer it; as alſo by reaſon that the vpper part of the earth lyeth very looſe and is exceeding porous, through the continuall operation of the ſunne and falling of raine vpon it. It can not chooſe therefore but mount to the ayre; and the ſame cauſe that maketh it do ſo, preſſeth att the ſame time the lower partes of the maſſe, downewardes. But what aſcendeth to the ayre, muſt be of the hoater and more moiſt partes of the fermenting maſſe; and what goeth downewardes muſt be of his harder and dryer partes proportionate to the contrary motiõs of fire and of earth, which predominate in theſe two kindes of partes. Now this that is pushed vpwardes, coming aboue ground, and being there expoſed to ſunne and wind, contracteth thereby a hard and rough skinne on its outſide; but within is more tender; in this ſort it defendeth it ſelfe from outward iniuries of weather whiles it mounteth: and by thruſting other partes downe into the earth, it holdeth it ſelfe ſteadfaſt, that although the wind may shake it, yet it can not ouerthrow it. The greater this plant groweth, the more iuice is dayly accrewed vnto it, and the heate is encreaſed; and conſequently, the greater aboundance of humors is continually ſent vp. Which when it

7. How plantes are framed.

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beginneth to clogge att the toppe, new humour preſſing vpwardes, forceth a breach in the skinne; and ſo a new piece, like the maine ſtemme, is thruſt out and beginneth on the ſides, which we call a branch. Thus is our plãt amplifyed, till nature not being able ſtill to breede ſuch ſtrong iſſues, falleth to workes of leſſe labour, and pusheth forth the moſt elaborate part of the plants iuice into more tender ſubſtances: but eſpecially, att the endes of the branches; where, aboundant humour, but att the firſt, not well concocted, groweth into the shape of a button; and more and better concocted humour ſucceding, it groweth ſofter and ſofter (the ſunne drawing the ſubtileſt partes outwardes) excepting what the coldneſſe of the ayre and the roughneſſe of the wind do harden into an outward skinne. So then the next partes to the skinne, are tender; but the very middle of this button muſt be hard and dry, by reaſon that the ſunne from without, and the naturall heate within, drawing and driuing out the moyſture and extending it from the center, muſt needes leaue the more earthy partes much shrũcke vp and hardened by their euaporating out from them: which hardening, being an effect of fire within and without, that baketh this hard ſubſtance, incorporateth much of it ſelfe with it, as we haue formerly declared in the making of ſalt by force of fire. This button, thus dilated, and brought to this paſſe, we call the fruite of the plant: whoſe harder part, encloſeth oftentimes, an other not ſo hard as dry. The reaſon whereof is becauſe the outward hardeneſſe permitteth no moyſture to ſoake in any aboundance through it; and then, that which is enclоſed in it, muſt needes be much dryed; though not ſo much, but that it ſtill retaineth the common nature of the plant. This drought, maketh theſe inner partes to be like a kind of duſt; or att the leaſt, ſuch as may be eaſily dryed into duſt, when they are bruſed out of the huske that encloſeth them. And in euery parcell of this duſt, the nature of the whole reſideth; as it were contracted into a ſmall quantity; for the iuice which was firſt in the button, and had paſſed from the roote through the manifold varieties of the diuers partes of the plant, and had ſuffered much concoction, partly from the ſunne and partly from the inward heate impriſoned in that harder part of the fruite; is by theſe paſſages, ſtrainings, and concoctions, become att the length to be like a tincture extracted out of the whole plant; and is att the laſt dryed vp into a kind of magiſtery. This we call the ſeede: which is, of a fitt nature, by being buried in the earth and diſſolued with humour, to renew and reciprocate the operation we haue thus deſcribed. And thus, you haue the formation of a Plant.

8. How ſenſitiue creatures are formed.

But a ſenſiue creature, being compared to a plant, as a plant is to a mixed body; you can not but conceiue that he muſt be compounded as it were of many plantes, in like ſort as a plant is of many mixed bodies. But ſo, that all the plants which concurre to make one animal, are of one kind of nature and cognation: and beſides; the matter, of which ſuch

diuerſity

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diuerſity is to be made, muſt of neceſſity be more humid and figurable, then that of an ordinary plant: and the artificer which worketh and mouldeth it, muſt be more actiue. Wherefore we muſt ſuppoſe that the maſſe, of which an animal is to be made, muſt be actually liquid: and the fire that worketh vpon it, muſt be ſo powerfull that of its owne nature, it may be able to conuert this liquide matter into ſuch breathes and ſteames, as we ſee do vſe to riſe from water, when the ſunne or fire worketh vpon it. Yet if the maſſe were altogether as liquide as water, it would vanish away by heate boyling it, and be dryed vp: therefore it muſt be of ſuch a conuenient temper, that although in ſome of its partes it be fluide and apt to runne; yet by others it muſt be held together; as we ſee that vnctuous thinges for the moſt part are; which will ſwell by heate, but not flye away.

So then if we imagine a great heate to be impriſoned in ſuch a liquour; and that it ſeeketh by boyling, to breake out; but that the ſolideneſſe and viſcouſneſſe of the ſubſtance will not permitt it to euaporate: it can not chooſe but comport it ſelfe in ſome ſuch ſort as we ſee butter or oyle in a frying panne ouer the fire, when it riſeth in bubbles: but much more efficaciouſly; for their body is not ſtrong enough to keepe in the heate; and therefore thoſe bubbles fall againe; whereas if it were, thoſe bubbles would riſe higher and higher, and ſtretch themſelues longer and longer (as when the ſoape boylers do boyle a ſtrong vnctuous lye into ſoape;) and euery one of them would be as it were a litle brooke, whereof the channell would be the encloſing ſubſtance; and the inward ſmoake that extendeth it, might be compared to the water of it: as when a glaſſe is blowne out by fire and ayre into a long figure.

Now we may remember, how we haue ſaid, where we treated of the production and reſolution of mixed bodies, that there are two ſortes of liquide ſubſtantiall partes, which by the operation of fire are ſent out of the body it worketh vpon; the watry, and the oyly partes. For though there appeare ſome times ſome very ſubtile and æthereall partes of a third kind (which are the aquæ ardentes, or burning ſpirits;) yet in ſuch a cloſe diſtilling of circulation as this is, they are not ſeuered by themſelues, but do accompagny the reſt; and eſpecially the watry partes: which are of a nature, that the riſing Ethereall ſpirits eaſily mingle with, and extend themſelues in it; whereby the water becometh more efficacious, and the ſpirits leſſe fugitiue.

Of theſe liquide partes which the fire ſendeth away, the watry ones are the firſt, as being the eaſieſt to be rayſed: the oyly partes, riſe more difficultly; and therefore do come laſt. And in the ſame manner it happeneth in this emiſſion of brookes, the watry and oyly ſteames will each of them flye into different reſerues; and if there arriue vnto them, aboundance of their owne quality, each of them muſt make a ſubſtance of its owne nature by ſettling in a conuenient place, and by due

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concoction. Which ſubſtance after it is made and confirmed, if more humidity and heate do preſſe it, will againe break forth into other litle channels. But when the watry and oyly partes are boyled away, there remaine yet behind other more ſolide and fixed partes, and more ſtrongly incorporated with fire then eyther of theſe: which yet can not drye vp into a fiery ſalt, becauſe a continuall acceſſiō of humour keepeth them alwayes flowing: and ſo they become like a couldron of boyling fire. Which muſt propagate it ſelfe as wide as eyther of the others; ſince the actiuity of it muſt needes be greater then theirs (as being the ſource of motion vnto them) and that there wanteth not humidity for it to extend it ſelfe by.

And thus you ſee three rootes of three diuers plants, all in the ſame plant, proceeding by naturall reſolution from one primitiue ſource. Whereof that which is moſt watry, is fitteſt to fabricate the body and common outſide of the triformed plant; ſince water is the moſt figurable principle that is in nature, and the moſt ſuſceptible of multiplication; and by its cold is eaſyeſt to be hardened, and therefore fitteſt to reſiſt the iniuries of enemy bodies that may infeſt it. The oyly partes, are fitteſt for the continuance and ſolidity of the plant: for we ſee that viſcoſity and oylineſſe, hold together the partes where they abound; and they are ſlowly waſted by fire, but do conſerue and are an aliment to the fire that conſumeth them. The partes of the third kind, are fitteſt for the conſeruation of heate: which though in them it be too violent; yet it is neceſſary for working vpon other partes, and for maine-taining a due temper in them.

And thus we haue armed our plant with three ſortes of riuers or brookes to runne through him, with as many different ſtreames; the one of a gentle balſamike oyle; an other, of ſtreaming fire; and the third of a connaturall and cooler water to irrigate and temper him. The ſtreames of water, (as we haue ſaid) muſt runne through the whole fabrike of this triformed plant: and becauſe it is not a ſimple water, but warme in a good degree, and as it were a middle ſubſtance betwixt water and ayre (by reaſon of the ardent volatile ſpiritt that is with it) it is of a fitt nature to ſwell as ayre doth; and yet withall to reſiſt violence in a conuenient degree, as water doth. Therefore, if from its ſource, nature ſendeth aboundance into any one part; that part muſt ſwell and grow thicker and shorter; and ſo, muſt be contracted that way which nature hath ordered it. Whence we perceiue a meanes, by which nature may draw any part of the outward fabrike, which way ſoeuer she is pleaſed by ſett inſtruments for ſuch an effect. But when there is no motion, or but litle in theſe pipes, the ſtanding ſtreame that is in a very litle, though long channell, muſt needes be troubled in its whole body, if any one part of it be preſſed vpon, ſo as to receiue thereby any impreſſion: and therefore, whatſoeuer is done vpon it, though att the very furtheſt end of it; maketh a commotion and ſendeth an impreſſion vp to its very ſource.

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Which appearing by our former discourse to be the origine of particular and occasionall motions; it is obuious to conceiue how it is apt to be moued and wrought by such an impression to sett on foote the beginning of any motion; which by natures prouidence is conuenient for the plant, when such an impression is made vpon it.

And thus you see this plant hath the vertue both of sense or feeling; that is, of being moued and affected by externe obiects, lightly striking vpon it; as also, of mouing it selfe, to or from such an obiect; according as nature shall haue ordained. Which in summe is; that this plant is a sensitiue creature, composed of three sources; the heart, the braine, and the liuer: whose offspringes are the arteries, the nerues, and the veines; which are filled with vitall spirits, with animal spirits, and with blood: and by these, the animal is heated, nourished, and made partaker of sense and motion.

Now referring the particular motions of liuing creatures, to an other time: we may obserue that both kindes of them, as well vegetables as animals do agree in the nature of sustaining themselues in the three common actions of generation, nutrition, and augmentation; which are the beginning, the progresse, and the conseruing of life. Vnto which three we may adde the not so much action as passion of death; and of sickneſſe or decay, which is the way to death.

THE FOVRE AND TWENTIETH CHAPTER.

A more particular suruay of the generation of Animals; in which is discouered what part of the animal is first generated.

TO beginne then with examining how liuing creatures are ingendered: our maine question shall be; whether they be framed entirely att once; or successiuely, one part after an other? And if this later way; which part first? Vpon the discussion of which, all that concerneth generation will be explicated, as much as concerneth our purpose in hand. To deduce this from its origine: we may remember how our Masters tell vs, that when any liuing creature is passed the heate of its augmentation or growing; the superfluous nourishment settleth it selfe in some appoynted place of the body to serue for the production of some other. Now it is euident that this superfluity cometh from all partes of the body, and may be said to containe in it, after some sort, the perfection of the whole liuing creature. Be it how it will, it is manifest that the liuing creature is made, of this superfluous moysture of the parent: which according to the opinion of some, being compounded of seuerall partes deriued from the seuerall limbes of the parent; those partes when they come to be fermented in conuenient heate and moysture, do take their posture, and

1. The opinion that the seede containeth formally euery part of the parent.

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ſituation, according to the poſture and diſpoſition of partes that the liuing creature had, from whence they iſſued: and then they growing dayly greater and ſolider, (the effects of moyſture and of heate;) do att the length become ſuch a creature as that was, from whence they had their origine.

Which, an accident that I remember, ſeemeth much to confirme. It was of a catt that had its tayle cutt of when it was very yong: which catt happening afterwardes to haue yong ones, halfe the kittlinges proued without tayles, and the other halfe had them in an ordinary manner; as if nature could ſupply but on the partners ſide, not on both. And an other particular that I ſaw when I was att Argiers, maketh to this purpoſe, which was, of a woman that hauing two thumbes vpon the left hand; foure daugthers that she had, did all reſemble her in the ſame accident, and ſo did a litle child, a girle of her eldeſt daugthers; but none of her ſonnes. Whiles I was there I had a particular curioſity to ſee them all: and though it be not eaſily permitted vnto Chriſtians to ſpeake familiarly with Mahometan women; yet the condition I was in there, and the ciuility of the Baſsha, gaue me the opportunity of full view and diſcourſe with them: and the old woman told me, that her mother and Grandmother had beene in the ſame manner. But for them, it reſteth vpon her creditt: the others I ſaw my ſelf.

2. The former opinion reiected,

But the opinion which theſe accidents ſeeme to ſupport; though att the firſt view it ſeemeth ſmoothly to ſatisfy our inquiry, and fairely to compaſſe the making of a liuing creature: yet looking further into it, we shall find it fall exceeding short of its promiſing; and meete with ſuch difficulties, as it can not ouercome. For firſt, lett vs caſt about how this compound of ſeuerall partes, that ſerueth for the generation of a new liuing creature, can be gathered from euery part and member of the parent; ſo to carry with it in litle the complete nature of it. The meaning hereof muſt be, that this ſuperfluous aliment, eyther paſſeth through all and euery litle part and particle of the parents body, and in its paſſage receiueth ſomething from them: or elſe, that it receiueth only from all ſimilar and great partes.

The former ſeemeth impoſſible, for how can one imagine that ſuch iuice should circulate the whole body of an animall, and viſit euery atome of it, and retire to the reſerue where ir is kept for generatiõ; and no part of it remaine abſolutely behind, ſticking to the flesh or bones that it bedeaweth; but that ſtill ſome part returneth backe from euery part of the animall? Beſides; conſider how thoſe partes that are moſt remote from the channels which conuey this iuice; when they are fuller of nourishment then they neede, the iuice which ouerfloweth from them, cometh to the next part, and ſettling there and ſeruing it for its due nourishment, driueth backe into the channell, that which was betwixt the channell and it ſelfe: ſo that here, there is no returne att all from ſome of the remote partes; and much of that iuice which is reiected,

neuer

neuer went farre from the channell it ſelfe. We may therefore ſafely conclude, that it is impoſſible, euery litle part of the whole body should remitt ſomething impregnated and imbued with the nature of it.

But then you may peraduenture ſay that euery ſimilar part doth. If ſo I would aske, how it is poſſible that by fermentation only, euery part should regularly goe to a determinate place, to make that kind of animal; in which, euery ſimilar part is diffuſed to ſo great an extent? How should the nature of flesh, here become broad, there round, and take iuſt the figure of the part it is to couer? How should a bone, here be hollow, there be blady, and in an other part take the forme of a ribbe, and thoſe many figures which we ſee of bones? And the like we might aske of euery other ſimilar part, as of the veines and the reſt. Againe; ſeeing it muſt of neceſſity happen, that att one time more is remitted from one part then from an other; how cometh it to paſſe, that in the collection the due proportion of nature is ſo punctually obſerued? Shall we ſay that this is done by ſome cunning artificer whoſe worke it is to ſett all theſe partes in their due poſture; which Ariſtotele attributeth to the ſeede of the Male? But this is impoſſible; for all this diuerſity of worke, is to be done att one time, and in the ſame occaſions: which can no more be effected by one agent, then multiplicity can immediately proceed from vnity.

But beſides that there can be no Agent to diſpoſe of the partes when they are gathered; it is euident that a ſenſitiue creature may be made without any ſuch gathering of partes beforehand from an other of the ſame kind: for elſe how could vermine breed out of liuing bodies, or out of corruption? How could ratts come to fill shippes, into which neuer any were brought? How could froggs be ingendred in the ayre? Eeles of deewy turfes, or of mudde? Toades of duckes? Fish, of hernes? And the like. To the ſame purpoſe; when one ſpecies or kind of animal is changed into an other; as when a catarpiller or a ſilkeworme becometh a flye; it is manifeſt that there can be no ſuch precedent collection of partes.

And therefore, there is no remedy; but we muſt ſeeke out ſome other meanes and courſe of generation, thē this. Vnto which we may be ledd, by conſidering how a liuing creature is nourished and augmented: for why should not the partes be made in generation of a matter like to that which maketh thē in nutritiō? If they be augmēted by one kind of iuice that after ſeuerall changes, turneth att the length into flesh and bone; and into euery ſort of mixed body or ſimilar part, whereof the ſenſitiue creature is compounded; and that ioyneth it ſelfe to what it findeth already made; why should not the ſame iuice, with the ſame progreſſe of heate and moyſture, and other due temperamēts; be conuerted att the firſt into flesh and bone though none be formerly there to ioyne it ſelfe vnto?

3. The Authors opinion of this queſtion.

Lett vs then conclude that the iuice which ſerueth for nourishmēt of the animal, being more then is requiſite for that ſeruice; the ſuperfluous part of it, is drained from the reſt, and is reſerued in a place fitt for it: where by litle and litle through digeſtion, it gaineth ſtrength and vigour

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and ſpirits to it ſelfe, and becometh an homogeneall body, ſuch as other ſimple compoundes are; which by other degrees of heate and moyſture, is changed into an other kind of ſubſtance: and that againe; by other temperaments, into an other. And thus; by the courſe of nature, and by paſſing ſucceſſiuely many degrees of temper, and by receiuing a totall change in euery one of them; att the length an animal is made of ſuch iuice as afterwardes ſerueth to nourish him.

4. Their opinion refuted, who hold that euery thing containeth formally all thinges.

But to bring this to paſſe a shorter way, and with greater facility; ſome haue beene of opimon, that all ſimilar thinges of whatſoeuer ſubſtance, are vndiſcernably mixed in euery thing that is: and that to the making of any body out of any thing; there is no more required but to gather together thoſe partes which are of that kind, and to ſeperate, and caſt away from them, all thoſe which are of a nature differing from them.

But this ſpeculation will appeare a very ayry and needeleſſe one, if we conſider into how many ſeuerall ſubſtances the ſame ſpecies of a thing may be immediately changed; or rather, how many ſeuerall ſubſtances may be encreaſed immediately from ſeuerall equall indiuiduals of the ſame thing; and then take an account how much of each indiuiduall is gone into each ſubſtance which it hath ſo encreaſed. For if wee ſumme vp the quantities that in the ſeuerall ſubſtances are thereby encreaſed; we ſhall find that they do very much exceed the whole quantity of any one of the indiuiduals: which ſhould not be if the ſuppoſition were true; for euery indiuiduall shonld be but one totall made vp of the ſeuerall different ſimilar partes, which encreaſe the ſeuerall ſubſtances, that extract out of them what is of their owne nature.

This will be better vnderſtood by an example: ſuppoſe that a man, a horſe, a cowe, a sheepe, and 500 more ſeuerall ſpecies of liuing creatures, should make a meale of lettuce: to auoyde all perplexity in conceiuing the argument, lett vs allow that euery one did eate a pound; and lett vs conceiue an other pound of this herbe to be burned; as much to be putrifyed vnder a Cabage roote; and the like vnder 500 plantes more of diuers ſpecies. Then caſt how much of euery pound of lettuce is turned into the ſubſtances that are made of them, or that are encreaſed by them; as, how much ashes, one pound hath made; how much water hath beene diſtilled out of an other pound; how much a man hath beene encreaſed by a third; how much a horſe by a fourth; how much earth by the putrefaction of a fifth pound, how much a cabage hath beene encreaſed by a ſixth: and ſo goe ouer all the poundes that haue beene turned into ſubſtances of different ſpecieſes (which may be multiplyed as much as you pleaſe.) And when you haue ſummed vp all theſe ſeuerall quantities, you will find them farre to exceed the quantity of one pound: which it would not do, if euery pound of lettuce were made vp of ſeuerall different ſimilar partes actually in it, that are extracted by different ſubſtances of the natures of thoſe partes; and that no ſubſtance could be encreaſed by it, vnleſſe partes of its nature were originally in the lettuce. On the

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5. The Authors opinion concerning the generation of Animals declared, and confirmed.

On the other ſide, if we but caſt our eye backe vpon the principles we haue layed where we diſcourſe of the compoſition of bodies, we ſhall diſcerne how this worke of changing one thing into an other; eyther in nutrition, in augmentation, or in generation; will appeare not only poſſible, but eaſy to be effected. For out of them, it is made euident how the ſeuerall varieties of ſolide and liquide bodies; all differences of naturall qualities, all conſiſtences, and whatſoeuer elſe belongeth to ſimilar bodies; reſulteth out of the pure and ſingle mixture of rarity and denſity; ſo that to make all ſuch varieties as are neceſſary, there is no neede of mingling, or of ſeperating any other kindes of partes: but only an art or power to mingle in due manner, plaine rare and denſe bodies one with an other. Which very action and none other (but with excellent methode and order, ſuch as becometh the great Architect that hath deſigned it) is performed in the generation of a liuing creature: which is made of a ſubſtance, att the firſt, farre vnlike what it afterwardes groweth to be.

If we looke vpon this change in groſſe, and conſider but the two extremes (to witt, the firſt ſubſtance, of which a liuing creature is made; and it ſelfe in its full perfection) I confeſſe, it may well ſeeme incredible how ſo excellent a creature can deriue its origine from ſo meane a principle, and ſo farre remote and differing from what it groweth to be. But if we examine it in retayle, and go along anatomiſing it in euery ſteppe and degree that it changeth by; we ſhall find, that euery immediate change is ſo neere, and ſo palpably to be made by the concurrent cauſes of the matter prepared; as we muſt conclude, it can not poſſibly become any other thing then iuſt what it doth become.

Take a beane, or any other ſeede, and putt it into the earth, and lett water fall vpon it; can it then chooſe but that the beane muſt ſwell? The beane ſwelling, can it chooſe but breake the skinne? The skinne broken can it chooſe (by reaſon of the heate that is in it) but push out more matter, and do that action which we may call germinating? Can theſe germes chooſe but pierce the earth in ſmall ſtringes, as they are able to make their way? Can theſe ſtringes chooſe but be hardened, by the compreſſion of the earth, and by their owne nature, they being the heauyeſt partes of the fermented beane? And can all this be any thing elſe but a roote? Afterwardes the heate that is in the roote, mingling it ſelfe with more moyſture, and according to its nature, ſpringing vpwardes; will it not follow neceſſarily, that a tender greene ſubſtance (which we call a budd, or leafe) muſt appeare a litle aboue the earth; ſince tenderneſſe, greeneneſſe, and aſcent, are the effects of thoſe two principles, heate and moyſture? And muſt not this greene ſubſtance change from what it was att the firſt, by the ſunne and ayre working vpon it, as it groweth higher; till att the length it hardeneth into a ſtalke? All this while, the heate in the roote ſublimeth vp more moyſture, which maketh the ſtalke att the firſt grow ranke and encreaſe in length.

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But when the more volatile part of that warme iuice, is ſufficiently depured and ſublimed, will it not attempt to thruſt it ſelfe out beyond the ſtalke with much vigour and ſmartneſſe? And as ſoone as it meeteth with the cold ayre in its eruption, will it not be ſtopped and thickned? And new partes flocking ſtill from the roote, muſt they not clogge that iſſue, and grow into a button, which will be a budd? This budde being hardened att the ſides, by the ſame cauſes which hardened the ſtalke, and all the while the inward heate ſtill ſtreaming vp, and not enduring to be long encloſed, (eſpecially when by its being ſtopped, it multiplyeth it ſelfe) will it not follow neceſſarily that the tender budde muſt cleaue, and giue way to that ſpirituall iuice; which being purer then the reſt (through its great ſublimation) sheweth it ſelfe in a purer and nobler ſubſtance then any that is yet made; and ſo becometh a flower? From hence, if we proceed as we haue begunne, and do weigh all circumſtances; we shall ſee euidently, that an other ſubſtance muſt needes ſucceed the flower, which muſt be hollow and containe a fruite in it: and that this fruite muſt grow bigger and harder. And ſo, to the laſt periode of the generation of new beanes.

Thus by drawing the thridde carefully along through your fingers, and ſtaying att euery knott to examine how it is tyed; you ſee that this difficult progreſſe of the generation of liuing creatures, is obuious enough to be comprehended; and that the ſteppes of it are poſſible to be ſett downe; if one would but take the paines and afford the time that is neceſſary (leſſe then that Philoſopher, who for ſo many yeares gaue himſelfe wholy vp to the ſingle obſeruing of the nature of bees) to note diligently all the circumſtances in euery change of it. In euery one of which the thing that was, becometh abſolutely a new thing; and is endewed with new properties and qualities different from thoſe it had before, as Phyſitians from their certaine experience, do aſſure vs. And yet euery change is ſuch, as in the ordinary and generall courſe of nature (wherein nothing is to be conſidered, but the neceſſary effects following out of ſuch Agents working vpon ſuch patients, in ſuch circumſtances) it is impoſſible that any other thing should be made of the precedent, but that which is immediately, ſubſequent vnto it.

Now if all this orderly ſucceſſion of mutations be neceſſarily made in a beane, by force of ſundry circumſtances and externall accidents; why may it not be conceiued that the like is alſo done in ſenſible creatures; but in a more perfect manner, they being perfecter ſubſtances? Surely the progreſſe we haue ſett downe is much more reaſonable, then to conceiue that in the meale of the beane, are contained in litle, ſeuerall ſimilar ſubſtances; as, of a roote, of a leafe, a ſtalke, a flower, a codde, fruite, and the reſt: and that euery one of theſe, being from the firſt ſtill the ſame that they shall be afterwardes, do but ſucke in, more moyſture from the earth, to ſwell and enlarge themſelues in quantity. Or, that in the ſeede of the male, there is already in act, the ſubſtance of flesh, of bone, of

bone, of ſinewes, of veines, and the reſt of thoſe ſeuerall ſimilar partes which are found in the body of an animall; and that they are but extended to their due magnitude, by the humidity drawne from the mother, without receiuing any ſubſtantiall mutation from what they were originally in the ſeede.

Lett vs then confidently conclude, that all generation is made of a fitting, but remote, homogeneall compounded ſubſtance: vpon which, outward Agents working in the due courſe of nature, do change it into an other ſubſtance, quite different from the firſt, and do make it leſſe homogeneall then the firſt was. And other circumſtances and agents, do change this ſecond into a thirde; that thirde, into a fourth; and ſo onwardes, by ſucceſſiue mutations (that ſtill make euery new thing become leſſe homogeneall, then the former was, according to the nature of heate, mingling more and more different bodies together) vntill that ſubſtance be produced, which we conſider in the periode of all theſe mutations.

And this, is euident out of many experiences: as for example in trees; the barke which is oppoſed to the north wind, is harder and thicker then the contrary ſide which is oppoſed to the ſouth, and a great difference will appeare in the graine of the wood; euen ſo much, that skilfull people, will by feeling and ſeeing a round piece of the wood after the tree is felled, tell you in what ſituation it grew, and which way each ſide of that peece looked. And Ioſephus Acoſta writeth of a tree in America, that on the one ſide being ſituated towardes great hills, and on the other being expoſed to the hoat ſunne; the one halfe of it flourisheth att one time of the yeare, and the other halfe att the oppoſite ſeaſon. And ſome ſuch like may be the cauſe of the ſtrãge effects we ſometimes ſee of trees, flourishing or bearing leafes att an vnſeaſonable time of the yeare; as in particular, in the famous oake in the Newforeſt; and in ſome others in our Iland: in which peraduenture the ſoyle they grow in, may do the ſame effect, as the windes and ſunne did in the tree that Acoſta maketh mention of. For we dayly ſee how ſome ſoyles are ſo powerfull ouer ſome kind of corne, that they will change the very nature of it; ſo that, you ſhall reape oates or rye, after you haue ſowen wheate there.

Which sheweth euidently that ſince the outward circumſtances can make the partes or the whole of any ſubſtance, become different from what they were att the firſt; generation is not made by aggregation of like partes to preſuppoſed like ones: nor by a ſpecificall worker within; but by the compounding of a ſeminary matter, with the iuice which accreweth to it from without, and with the ſteames of circumſtant bodies; which by an ordinary courſe of nature, are regularly imbibed in it by degrees; and which att euery degree, do change it into a different thing, ſuch an one as is capable to reſult out of the preſent compound, (as we haue ſaid before) vntill it arriue to its full perfection.

6. That one ſubſtance is changed into an other.

Which yet is not the vtmoſt periode of natures changes; for from

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that; for example, from corne or an animal, it carryeth it on (ſtill changing it) to be meale or a cadauer: from thence to be bread or durte: after that to be bloud or graſſe. And ſo, ſtill turning about her wheele (which ſuffereth nothing to remaine long in the ſtate it is in) she changeth all ſubſtances from one into an other. And by reiterated reuolutions, maketh in time euery thing of euery thing: as when of mudde she maketh tadpoles, and frogges, of them; and afterwardes, mudde againe of the frogges: or when she runneth a like progreſſe; from earth to wormes; and from them, to flyes; and the like: ſo changing one animal into ſuch an other; as in the next precedent ſteppe, the matter in thoſe circumſtances is capable of being changed into; or rather (to ſay better) muſt neceſſarily be changed into.

To confirme this by experience; I haue beene aſſured, by one who was very exact in noting ſuch thinges; that he once obſerued in Spaine, in the ſpring ſeaſon, how a ſticke lying in a moyſt place, grew in tract of time to be moſt of it a rotten durty matter; and that att the durty end of the ſticke, there began a rude head to be formed of it by litle and litle; and after a while ſome litle legges began to diſcouer themſelues neere this vnpolished head, which dayly grew more and more diſtinctly shaped. And then, for a pretty while (for it was in a place where he had the conueniencye, to obſerue dayly the progreſſe of it, and no body came neere to ſtirre it in the whole courſe of it) he could diſcerne where it ceaſed to be a body of a liuing creature, and where it began to be dead ſtiche or durt; all in one continuate quantity or body. But euery day the body grew longer and longer, and more legges appeared, till att the length, when he ſaw the animal almoſt finished, and neere ſeperating it ſelfe from the reſt of the ſticke, he ſtayed then by it, and ſaw it creepe away in a catarpillar, leauing the ſticke and durt, as much wanting of its firſt length, as the wormes body tooke vp. Peraduenture the greateſt part of ſuch creatures maketh their way by ſuch ſteppes into the world. But to be able to obſerue their progreſſe thus diſtinctly as this Gentleman did, happeneth not frequently.

7. Concerning the hatching of chickens, and the generation of other Animals.

Therefore, to ſatisfy our ſelues herein it were well we made our remarkes in ſome creatures that might be continually in our power to obſerue in them the courſe of nature euery day and houre. Sir Ihon Heydon, the Lieutenant of his Maieſties ordinance (that generous and knowing Gentleman; and conſummate ſouldier both in theory and practiſe) was the firſt that inſtructed me how to do this, by meanes of a furnace ſo made as to imitate the warmeth of a ſitting henne. In which you may lay ſeuerall egges to hatch; and by breaking them at ſeuerall ages you may diſtinctly obſerue euery hourely mutation in them, if you pleaſe. The firſt will bee, that on one ſide you shall find a great reſplendent clearneſſe in the white. After a while, a litle ſpott of red matter like bloud, will appeare in the middeſt of that clearneſſe faſtened to the yolke: which will haue a motion of opening

and

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and shutting; so as sometimes you will see it, and straight againe it will vanish from your sight; and indeede att the first it is so litle, that you can not see it, but by the motion of it; for att euery pulse, as it openeth, you may see it, and immediately againe, it shutteth in such sort, as it is not to be discerned. Frō this red specke, after a while there will streame out, a number of litle (almost imperceptible) red veines. Att the end of some of which, in time there will be gathered together, a knotte of matter which by litle and litle, will take the forme of a head; and you will ere long beginne to discerne eyes and a beake in it. All this while the first red spott of blood, groweth bigger and solider: till att the length, it becometh a fleshy substance; and by its figure, may easily be discerned to be the hart: which as yet hath no other encloſure but the substance of the egge. But by litle and litle the rest of the body of an animal is framed out of those red veines which streame out all aboute from the hart. And in processe of time, that body incloseth the heart within it by the chest, which groweth ouer on both sides, and in the end meeteth, and closeth it selfe fast together. After which this litle creature soone filleth the shell, by conuerting into seuerall partes of it selfe all the substance of the egge. And then growing weary of so straight an habitation, it breaketh prison, and cometh out, a perfectly formed chicken.

In like manner: in other creatures; which in latin are called *Viuipara* (because their yong ones are quicke in their mothers wombe) we haue, by the relation of that learned and exact searcher into nature, Doctor Haruey: that the seede of the male after his accoupling with the female, doth not remaine in her wombe in any sensible bulke: but (as it seemeth) euaporateth and incorporateth it selfe, eyther into the body of the wombe, or rather into some more interior part, as into the seminary vessells. Which being a solide substance, much resembling the nature of the females seede, is likely to sucke vp, by the mediation of the females seede, the male seede incorporated with it, and by incorporation, turned (as it were) into a vapour: in such sort as we haue formerly explicated how the body of a scorpion or viper, draweth the poyson out of a wound. And after a certaine time (Doctor Haruey noted the space of sixe weekes or two months in does or hindes) these seedes distill againe into the wombe; and by litle and litle do clarify in the middest, and a litle red specke appeareth in the center of the bright clearnesse: as we said before of the egge.

8. From whence it happeneth that the deficiences, or excrescences of the parents body are often seene in their children.

But we should be too blame to leaue our Reader without clearing that difficulty, which can not, choose but haue sprung vp in his thoughts, by occasion of the relations we made att the entrance into this point concerning the catte whose kittlinges were halfe with tayles, and halfe without: and the womans daughters att Argires, that had as well as their mother excrescences vpon their left thumbes, imitating an other lesser thumbe: and the like effects whensoeuer they happen, which they do frequently enough.

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Lett him therefore remember, how we haue detetmined that generation is made of the bloud, which being diſperſed into all the partes of the body to irrigate euery one of them; and to conuey fitting ſpirits into them fró their ſource or shoppe where they are forged; ſo much of it as is ſuperaboundant to the nourishing of thoſe partes is ſent backe againe to the hart to recouer the warmeth and ſpirits it hath loſt by ſo long a iourney. By which perpetuall courſe of a continued circulation, it is euident that the bloud in running thus through all the partes of the body muſt needes receiue ſome particular concoction or impreſſiòn from euery one of them. And by conſequence, if there be any ſpecificall vertue in one part which is not in an other, then the bloud returning from thence muſt be endewed with the vertue of that part. And the pureſt part of this bloud, being extracted like a quinteſſence out of the whole maſſe, is reſerued in conuenient receptacles or veſſels till there be vſe of it: and is the matter or ſeede, of which a new animal is to be made; in whom, will appeare the effect of all the ſpecificall vertues drawne by the bloud in its iterated courſes, by its circular motion, through all the ſeuerall partes of the parents body.

Whence it followeth, that if any part be wanting in the body whereof this ſeede is made, or be ſuperaboundant in it; whoſe vertue is not in the reſt of the body, or whoſe ſuperaboundance is not allayed by the reſt of the body; the vertue of that part, can not be in the bloud, or will be too ſtrong in the blood, and by conſequence, it can not be at all, or it will be, too much in the ſeede. And the effect proceeding from the ſeede, that is, the yong animal will come into the world ſauouring of that origine; vnleſſe the mothers ſeede, do ſupply or temper, what the fathers was defectiue or ſuperaboundant in; or contrariwiſe the fathers do correct the errors of the mothers.

9. The difference between the Authors opinion, and the former one.

But peraduenture the Reader will tell vs, that ſuch a ſpecificall vertue can not be gotten by concoction of the bloud, or by any pretended impreſſion in it; vnleſſe ſome litle particles of the nourished part do remaine in the bloud, and returne backe with it according to that maxime of Geber: *Quod non ingreditur, non immutat*; no body can change an other, vnleſſe it enter into it, and mixing it ſelfe with it do become one with it. And that ſo in effect, by this explication we fall backe into the opinion which we reiected.

To this I anſwere, that the difference is very great betweene that opinion and ours; as will appeare euidently, if you obſerue the two following aſſertions of theirs. Firſt, they affirme that a liuing creature is made meerely by the aſſembling together of ſimilar partes, which were hidden in thoſe bodies from whence they are extracted in generation: whereas we ſay that bloud coming to a part to irrigate it, is by its paſſage through it, and ſome litle ſtay in it, and by its frequent returnes thither, att the length tranſmuted into the nature of that part: and thereby the ſpecificall vertues of euery part, do grow greater, and are more diffuſed and extended.

Secondly,

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Secondly, they say that the embryon is actually formed in the seede, though in such litle partes as it can not be discerned, vntill each part haue enlarged and encreased it selfe, by drawing vnto it from the circumstant bodies more substance of their owne nature. But we say, that there is one homogeneall substance, made of the bloud, which hath beene in all partes of the body; and this is the seede: which containeth not in it, any figure of the animal from which it is refined, or of the animal into which it hath a capacity to be turned (by the addition of other substances) though it haue in it the vertues of all the partes it hath often runne through.

By which terme of specifike vertues, I hope we haue said enough in sundry places of this discourse to keepe men from conceiuing that we do meane any such vnconceiueable quality, as moderne Philosophers too frequently talke of, when they know not what they say or think, nor can giue any account of. But that it is such degrees and such numbers, of rare and dense partes mingled together, as constitute a mixed body of such a temper and nature: which degrees and proportions of rare and dense partes and their mixture together, and incorporating into one homogeneall substance, is the effect resulting from the operations of the exteriour agent, that cutteth, imbibeth, kneadeth, and boyleth it to such a temper: which exteriour agent in this case, is each seuerall part of the animals body, that this iuice or bloud runneth through; and that hath a particular temper belonging to it, resulting out of such a proportion of rare and dense partes, as we haue euen now spoken of; and can no more be withheld from communicating its temper to the bloud that first soaketh into it, and soone after drayneth away againe from it (according as other succeeding partes of bloud driue it on;) then a minerall channell can choose, but communicate its vertue vnto a streame of water that runneth through it, and is continually grating of some of the substance of the minerall earth, and dissoluing it into it selfe.

10. That the hart is imbued with the generall specifike vertues of the whole body; whereby is confirmed the doctrine of the two former paragraphes.

But to goe on with our intended discourse. The seede, thus imbued with the specificall vertues of all the seuerall partes of the parents body, meeting in a fitt receptacle the other partners seede; and being there duly concocted, becometh first a hart: which hart in this tender beginning of a new animal containeth the seuerall vertues of all the partes that afterwardes will grow out of it, and be in the future animal; in the same manner as the hart of a complete animal containeth in it the specifike vertues of all the seuerall partes of its owne body, by reason of the bloudes continuall resorting to it in a circle from all partes of its body, and its being nourished by that iuice to supply the continuall consumption which the extreme heate of it must needes continually occasion in its owne substance; whereby the hart becometh in a manner the compendium or abridgement of the whole animal.

Now this hart in the growing Embryon, being of the nature of fire;

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as on the one ſide it ſtreamerh out its hoat partes; ſo on the other, it ſucketh oyle or fewell to nourish it ſelfe out of the adiacent moiſt partes; which matter aggregated vnto it, being ſent abroad together with the other hoat partes that ſteame from it; both of them together, do ſtay and ſettle as ſoone as they are out of the reach of that violent heate that would not permitt them to thicken or to reſt. And there they grow into ſuch a ſubſtance as is capable to be made of ſuch a mixture, and are linked to the hart by ſome of thoſe ſtringes that ſteame out from it (for thoſe ſteames do likewiſe harden, as we shewed more particularly when we diſcourſed of the tender ſtalkes of plantes) and in a word, this becometh ſome other part of the animal. Which thus encreaſeth by order, one part being made after an other, vntill the whole liuing creature be completely framed.

So that now you ſee; how mainely their opinion differeth from ours; ſince they ſay that there is actually in the ſeede, a complete liuing creature: for what elſe is a liuing creature, but bones in ſuch partes, nerues in ſuch others, bloud and humors contained in ſuch and ſuch places; all, as in a liuing creature? All which they ſay. But we make the ſeede to be nothing elſe, but one mixed body, of one homogeneall nature throughout; conſiſting of ſuch a multiplicity of rare and denſe partes; ſo ballanced and proportioned, in number and in magnitude of thoſe partes; which are euenly shuffled, and alike mingled in euery litle parcell of the whole ſubſtance: in ſuch ſort, that the operation of nature vpon this ſeede, may in a long time and with a dew proceſſe, bring out ſuch figures, ſituation, and qualities, (as fluidity, conſiſtence, dryneſſe, and the like) which by much mixtion and conſequent alteration, may in the end become ſuch as conſtitute a liuing creature of ſuch a kind. And thus it appeareth, that although other ſubſtances, and liquours, and ſteames are from time to time mingled with the ſeede, and then with the hart, and afterwardes with the other partes, as they grow on and encreaſe; yet the maine vertue of the enſuing animal, is firſt in the ſeede and afterwardes in the hart.

Whence the reaſon is euident, why both defects and excreſcences, do paſſe ſometimes from the parents to the children; to witt, when nothing ſupplyeth the defect or correcteth the exorbitancy. Rather after this which we haue ſaid, the difficulty will appeare greater, in that ſuch accidents are not alwayes hereditary from the parents; but happen only now and then, ſome rare times. But the ſame groundes we haue layed will likewiſe ſolue this obiection; for ſeeing that the hart of the animal, from whence the ſeede receiueth its proper nature (as we haue declared) is impregnated with the ſpecifike vertue of each ſeuerall part of the body; it can not be doubted but that the hart will ſupply for any defect happened in any part, after it hath been imbued with that vertue, and is growne to a firmeneſſe, and vigorous conſiſtence with that vertue moulded, and deepely imbibed into the very ſubſtance of it. And

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although the hart should be tincted from its first origine with an vndew vertue from some part (as it seemeth to haue been in the mother of those daugthers that had two thumbes vpon one hand:) yet it is not necessary that all the offspring of that parent should be formed after that modell; for the other partners seede may be more efficacious, and predominate in the geniture, ouer the faulty seede of the other parent; and then it will supply for, and correct, the others deuiation from the generall rule of nature. Which seemeth to be the case of that womans male children; for in them, the fathers seede being strongest, all their fingers imitated the regularity of their fathers: whereas the daughters (whose sexe implyeth that the fathers seede was lesse actiue) carried vpon some of theirs, the resemblance of their mothers irregularity.

And in confirmation of this doctrine, we dayly see that the children of parents, who haue any of their noble partes much and long distempered, whereby there must be a great distemper in the bloud (which is made and concocted by their assistance) do seldome faile of hauing strong inclinations to the distempers and diseases that eyther of their parents were violently subiect vnto. Scarce any father or mother dyeth of the consumption of the lunges, but their children inherite that disease in some measure: the like is of the stone; the like of the gowte; the like of diseases of the braine, and of sundry others; when they infested the parents with any notable eminency. For the bloud coming continually to the hart from such ill affected partes by its circulation through the whole body must needes in processe of time alter, and change the temper of the hart: and then both the hart giueth a tainted impression to the bloud that must be boyled into seede; and the partes themselues do communicate their debilities, and distempers vnto it: so that it is no wonder, if the seede do partake of such depraued qualities; since it is a maxime among Physitians, that subsequent concoctions, can neuer amend or repaire the faultes of the precedent ones.

II. That the hart is the first part generated in a liuing creature.

Hauing waded thus farre into this matter; and all experience agreeing that the whole animal is not formed att once: I conceiue there can be no great difficulty in determining what parte of it is first generated: which we haue already said to be the hart; but peraduenture the reader may expect some more particular and immediate proofe of it. It is euident that all the motions and changes, which we haue obserued in the egge and in the Doe, do proceed from heate: and it is as certaine that heate is greatest in the center of it; from whence it disperseth it selfe to lesse and lesse. It must then necessarily follow, that the part in which heate doth most abound; and which is the interiour fountaine of it, from whence (as from a stocke of their owne) all the other partes deriue theirs; must be formed first and the others successiuely after it, according as they partake more or lesse, of this heate; which is the Architect that moulded and frameth them all. Vndoubtedly this can be none other, but the hart: whose motion and manner of working, euidently appeareth in the

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twinckling of the first red spotte (which is the first change) in the egge, and in the first matter of other liuing creatures. Yet I do not intend to say, that the hart is perfectly framed, and completely made vp, with all its partes and instruments, before any other part be begunne to be made: but only the most vertuous part; and as it were the marrow of it; which serueth as a shoppe or a hoat forge, to mould spirits in: from whence they are dispersed abroad to forme and nourish other partes that stand in neede of them to that effect.

The shootings or litle red stringes that streame out from it, must surely be arteries; through which, the bloud issuing from the hart, and there made and imbued with the nature of the seede, doth runne; till encountring with fitt matter, it engrosseth it selfe into braine, liuer, lightes &c. From the braine cheifely groweth the marrow, and by consequent the bones containing it, (which seeme to be originally, but the outward part of the marrow, baked and hardened into a strong cruste by the great heate that is kept in:) as also the sinnewes; which are the next principall bodies of strength, after the bones. The marrow being very hoat, dryeth the bones; and yet with its actuall moysture, it humecteth and nourisheth them too, in some sort. The spirits that are sent from the braine, do the like to the sinewes. And lastly, the arteries and veines by their bloud to cherish and bedew the flesh. And thus, the whole liuing creature is begunne, framed, and made vp.

THE FIVE AND TWENTIETH CHAPTER.

How a Plant or Animal cometh to that figure it hath.

1. That the figure of an Animal is produced by ordinarie secõd causes, as well as any other corporeall effect.

BVt before we goe any further, and search into the operations of this animall, a wonderfull effect calleth our consideration vnto it: which is how a plant or animal, cometh by the figure it hath, both in the whole and in euery part of it? Aristotle after he had beaten his thoughts as farre as he could vpon this question, pronunced that this effect could not possibly be wrought by the vertue of the first qualites; but that it sprung from a more diuine origine. And most of the contemplators of nature since him, do seeme to agree that no cause can be rendered of it; but that it is to be referred meerely to the specificall nature of the thing. Neyther do we intend to derogate from eyther of these causes; since that both diuine prouidence is eminently shewne in contriuing all circumstances necessary for this worke; and likewise the first temperament that is in the seede, must needes be the principall immediate cause of this admirable effect.

This latter then being supposed, our labour and endeauour will be, to vnfold (as farre as so weake and dimme eyes can reach) the excellency and exactnesse of Gods prouidence, which can not be enough adored, when it is

it is reflected vpon, and marked in the apt laying of adequate causes to produce such a figure out of such a mixture first layed. From them so artificially ranged, we shall see this miracle of nature to proceed; and not from an immediate working of God or nature without conuenient and ordinary instruments to mediate and effect this configuration, through the force and vertue of their owne particular natures. Such a necessity to interest the cheife workeman att euery turne, in particular effects, would argue him of want of skill and prouidence, in the first laying of the foundations of his designed machine: he were an improuident clockemaker, that should haue cast his worke so, as when it were wound vp and going, it would require the masters hand att euery houre to make the hammer strike vpon the bell. Lett vs not then too familiarly, and irreuerently ingage the Almighty Architect his immediate handy worke in euery particular effect of nature; *Tali non est dignus vindice nodus.*

2. That the seuerall figures of bodies proceed from a defect in one of the three dimensions, caused by the concurrāce of accidentall causes.

But lett vs take principles within our owne kenning; and consider how a body hath of its owne nature three dimensions, (as Mathematicians vse to demonstrate:) and that the variety which we see of figures in bodies, proceedeth out of the defect of some of these dimensions in proportion to the rest. As for example; that a thing be in the forme of a square tablette; is, for that the cause which gaue it length and breadth, could not also giue it thickenesse in the same proportion: for had it beene able to giue profundity as well as the other two, it had made a cube instead of a tablette. In like manner, the forme of a lamine, or very long square is occasioned by some accident which hindereth the cause from giuing breadth and thickenesse proportionable to the length. And so, other figures are made, by reason that their causes are somewayes bound to giue more of some dimension to one part then to an other.

As for example; when water falleth out of the skye, it hath all the litle corners or extancies of its body grated of by the ayre as it rouleth and tumbleth downe in it; so that it becometh round; and continueth in that forme, vntill that settling vpon some flatt body, as grasse or a leafe, it receiueth a litle plaineneſſe, to the proportion of its weight mastering the continuity of it. And therefore, if the droppe be great vpon that plaine body, it seemeth to be halfe a sphere, or some lesse portion of one: but if it be a litle droppe then the flatt part of it (which is that next vnto the grasse) is very litle and vndiscernable; becaus it hath not weight enough to presse it much and spread it broad vpon the grasse; and so the whole, seemeth in a manner to be a sphere: but if the externe causes had pressed vpon this droppe, only broadwayes and thickewayes (as when a turner maketh a round pillar of a square one) then it would haue proued a cylinder, nothing working vpon it to grate off any of its length, but only the corners of the breadth and thickenesse of it.

And thus you see, how the fundamentall figures (vpon which all the rest are grounded) are contriued by nature; not by the worke of any

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particular Agent that immediately imprinteth a determinate figure into a particular body, as though it wrought it there att once, according to a foreconceiued designe or intelligent ayme of producing such a figure in such a body: but by the concurrence of seuerall accidentall causes, that do all of them ioyne in bringing the body they file and worke vpon, into such a shape.

Only we had like to haue forgotten the reason and cause of the concaue figure in some partes of plantes: which in the ordinary course of nature we shall find to grow from hence; that a round outside being filled with some liquor which maketh it grow higher and higher, it happeneth that the succeeding causes do contract this liquor, and do harden the outside: and then, of necessity there must be a hollow cylinder remayning in lieu of the iuice which before did fill it. As we see euery day in corne, and in reedes, and in canes, and in the stalkes of many herbes: which whilst they are tender and in their first groweth, are full of iuice; and become afterwardes hollow and drye.

3. The former doctrine is confirmed by seuerall instances.

But because this discourse, may peraduenture seeme too much in common: it will not be amisse to apply it to some particulars that seeme very strange. And first, lett vs examine how the rocking of concrete iuices (which seemeth to be such an admirable mystery of nature) is performed. Alume falleth downe in lumpes, saltpeter in long ycickles, and common salt in squares; and this, not once, or sometimes now and then; but alwayes constantly in the same order.

The reason of these effects will easily be deduced out of what we haue said; for if all three be dissolued in the same water, alume being the grosseste falleth first and fastest: and being of an vnctuous nature, the first part which falleth doth not harden, till the second cometh to it; whereby this second sticketh to the first and crusheth it downe; and this is serued in the same manner by the third; and so goeth on, one part squeezing an other, till what is vndermost grow hard enough to resist the weight of new falling partes; or rather till no more do fall, but the liquor they were dissolued in, is deliuered of them all; and then they harden in that figure they were compressed into.

As for salt, which descendeth in the second place: that swimmeth first vpon the water; and there, getteth its figure; which must be equally long and broad, because the water is indifferent to those two positions; but its thickenesse is not equall to its other two dimensions, by reason that before it can attaine to that thicknesse, it groweth too heauy to swimme any longer; and after it is encreased to a certaine bulke, the weight of it carrieth it downe to the bottome of the water, and consequently it can encrease no more: for it encreaseth by the ioyning of litle partes vnto it as it swimmeth on the toppe of the water.

The saltpeter falleth last: which being more difficult to be figured then the other two, because it is more dry then eyther of them (as consisting chiefely of earthy and of fyry partes,) is not equally encreased,

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encreased, neyther in all three, nor in two dimensions, but hath its length exceeding both its breadth and thickenesse: and its lightnesse, maketh it fall last, because it requireth least water to sustaine it.

To giue the causes of the figures of diuers mixtes, and particularly of some pretious stones, (which seeme to be cast by nature in exactest mouldes) would oblige vs to enter into the particular manner of their generation: which were exceeding hard, if not impossible, for vs to do, by reason that Authors haue not left vs the circumstances vpon which we might ground our iudgement concerning them, so particularly described as were necessary; nor our selues haue mett with the commodity of making such experiences, and of searching so into their beds as were requisite, to determine solidely the reasons of them. And indeede I conceiue that oftentimes the relations which others haue recorded of their generation, would rather misseleade then assist vs: since it is very familiar in many men, to magnify the exactenesse of nature in framing effects they fansye to themselues, when to make their wonder appeare more iust; they will not fayle to sett of their story, with all aduantageous circumstances, and helpe out what wanteth a litle or cometh but neere the marke.

But to come closer to our purpose; that is, to the figures of liuing thinges; we see that rootes in the earth, are all of them figured almost in the same fashion: for the heate residing in the middest of them, pusheth euery way, and therevpon, some of them do become round, but others more long then round, according to the temper of the ground, or to the season of the yeare, or to the weather that happeneth: and this, not only in diuers kindes of rootes, but euē in seuerall of the same kinde. That part of the plant which mounteth vpwardes, is for the most part round and long; the cause whereof is euident, for the iuice which is in the middle of it working vpwardes (because the hardenesse of the barke will not lett it out att the sides) and coming in more and more aboundance (for the reasons we haue aboue deliuered) encreaseth that part equally euery way but vpwardes; and therefore, it must be equally thicke and broad, and consequently round: but the length will exceed eyther of the other dimensions; because the iuice is driuen vp with a greater force and in more quantity then it is to the sides. Yet the broadnesse and thickenesse are not so exactly vniforme, but that they exceede a little more att the bottome then att the toppe; which is occasioned partly by the contracting of the iuice into a narrower circuite the further it is from the source; and partly by reason of the branches; which shooting forth, do conuey away a great part of the iuice from the maine stocke.

4. The same doctrine applyed to Plants.

Now if we consider the matter well; we shall find, that what is done in the whole tree the very same is likewise done in euery litle leafe of it; for a leafe consisteth of litle branches shooting out from one greater branch, which is in the middle: and againe, other lesser branches are deriued from those second branches: and so still lesser and lesser, till they

5. The same doctrine declared in leafes of trees.

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weaue themſelues into a cloſe worke, as thicke as that which we ſee women vſe to fill vp with ſilke or crewell, when in tenteworke they embroader leafes or flowers vpon canneuas: and this againe; is couered and as it were glewed ouer, by the humour which ſticking to theſe litle thriddes, ſtoppeth vp euery litle vacuity, and by the ayre is hardened into ſuch a skinne as we ſee a leafe conſiſteth of.

And thus it appeareth how an account may be giuen of the figure of the leafes, as well as of the figure of the maine body of the whole tree: the litle branches of the leafe, being proportionate in figure to the branches of the tree it ſelfe (ſo that each leafe ſeemeth to be the tree in litle;) and the figure of the leafe depending of the courſe of theſe litle branches, ſo that if the greateſt branch of the tree be much longer then the others, the leafe will be a long one: but if the leſſer branches ſpread broadwayes; the leafe will likewiſe be a broad one; ſo farre, as euen to be notched att the outſides, round about it, in great or litle notches, according to the proportion of the trees branches. Theſe leafes, when they firſt breake out, are foulded inwardes, in ſuch ſort as the ſmallneſſe and roundneſſe of the paſſage in the wood through which they iſſue, conſtrayneth them to be; where neuertheleſſe the dryneſſe of their partes, keepe them aſunder; ſo that one leafe doth not incorporate it ſelfe with an other: but as ſoone as they feele the heate of the ſunne (after they are broken out into liberty) their tender branches by litle and litle grow more ſtraight; the concaue partes of them drawing more towardes the ſunne, becauſe he extracteth and ſucketh their moyſture from their hinder partes into their former, that are more expoſed to his beames; and thereby the hinder partes are contracted and grow shorter, and thoſe before grow longer. Which if it be in exceſſe, maketh the leafe become crooked the contrary way; as we ſee in diuers flowers, and in ſundry leafes during the ſummers heate: witteneſſe, the yuy, roſes full blowne, tulipes, and all flowers in forme of bells; and indeede all kindes of flowers what ſoeuer; when the ſunne hath wrought vpon them to that degree we ſpeake of, and that their ioyning to their ſtalke, and the next partes thereunto, allow them ſcope to obey the impulſe of thoſe outward cauſes. And when any do vary from this rule; we ſhall as plainely ſee other manifeſt cauſes producing thoſe different effects, as now we do theſe working in this manner.

As for fruites though we ſee that when they grow att liberty vpon the tree, they ſeeme to haue a particular figure alloted them by nature: yet in truth, it is the ordered ſeries of naturall cauſes and not an intrinſecall formatiue vertue which breedeth this effect, as is euident by the great power which art hath to change their figures att pleaſure; whereof you may ſee examples enough in Campanella; and euery curious gardner can furnish you with ſtore.

6. The ſame applyed to the bodies of Animals.

Out of theſe, and ſuch like principles a man that would make it his ſtudy with leſſe trouble or tedioufneſſe, then that patient contemplator of one

of one of natures litle workes (the Bees) whom we mentioned a while agone, might without all doubt trace the causes in the growing of an Embryon, till he discouered the reason of euery bones figure; of euery notable hole or passage that is in them; of the ligaments by which they are tyed together; of the membranes that couer them; and of all the other partes of the body. How, out of a first masse, that was soft, and had no such partes distinguishable in it, euery one of thē came to be formed, by contracting that masse in one place, by dilating it in an other, by moystening it in a third, by drying it here, hardening it there;

Vt his exordia primis,
Omnia, & ipse tener hominis concreuerit orbis.

till in the end this admirable machine and frame of mans body, was composed and fashioned vp by such litle and almost insensible steppes and degrees. Which when it is looked vpon in bulke, and entirely formed, seemeth impossible to haue beene made, and to haue sprung meerely out of these principle, without an Intelligence immediately working and moulding it att euery turne, from the beginning to the end.

7. In what sense the Author doth admitt of *Vis formatrix.*

But withall, we can not choose but breake out into an extasye of admiration and hymnes of prayse (as great Galen did vpon the like occasion) when we reuerently consider the infinite wisedome; and deepe farrelooking prouidence of the allseeing Creator and orderer of the world, in so punctually adapting such a multitude and swarme of causes to produce by so long a progresse so wonderfull an effect: in the whole course of which, if any one, the very least of them all, went neuer so litle awry, the whole fabrike would be discomposed and changed from the nature it is designed vnto.

Out of our short suruay of which (answerable to our weake talents, and slender experience) I persuade my selfe it appeareth euident enough, that to effect this worke of generation, there needeth not be supposed a forming vertue or *Vis formatrix* of an vnknowne power and operation, as those that consider thinges soddainely and but in grosse, do vse to putt. Yet, in discourse, for conueniency and shorteneſse of expression we shall not quite banish that terme from all commerce with vs; so that what we meane by it, be rightly vnderstood; which is, the complexe, assemblement, or chayne of all the causes, that concurre to produce this effect; as they are sett on foote, to this end by the great Architect and Moderator of them, God almighty, whose instrument nature is: that is, the same thing, or rather the same thinges so ordered as we haue declared, but expressed and compriſed vnder an other name.

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THE SIX AND TWENTIETH CHAPTER.

How motion beginneth in liuing creatures. And of the motion of the hart; circulation of the bloud; Nutrition; Augmentation; and corruption or death.

1. From whence doth proceed the primary motion and growth in Plantes.

BVt we must not take our leaue of this subiect, vntill we haue examined, how motion beginneth in liuing thinges; as well plants as sensitiue creatures. We can readily pitch vpon the part we are to make our obseruations in, for retriuing the origine of this primary motion: for hauing concluded that the rootes of plants, and the harts of animals are the partes of them, which are first made, and from which the forming vertue is deriued to all the rest, it were vnreasonable to seeke for their first motion any where else.

But in what manner, and by what meanes, doth it beginne there? For rootes, the difficulty is not great; for the moysture of the earth, pressing vpon the seede, and soaking into it; the hoat partes of it which were imprisoned in cold and dry ones, are thereby stirred vp and sett on worke: then they mingling themselues with that moysture, do ferment and distend the whole seede; till making it open, and breake the skinne more iuice cometh in: which incorporating it selfe with the heate, those hoat and now moyst partes will not be contained in so narrow a roome as att the first; but struggling to gett out on all sides, and striuing to enlarge thēselues; they thrust forth litle partes: which, if they stay in the do earth, grow white and make the roote: but those which asceād, and make their way into the ayre, being lesse compressed, and more full of heate and moysture, do turne greene: and as fast as they grow vp, new moysture coming to the roote, is sent vp through the pores of it: and this faileth not, vntill the heate of the roote it selfe doth faile. For it being the nature of heate to rarify and eleuate, there must of necessity be caused in the earth a kind of sucking in of moysture into the roote frō the next partes vnto it to fill those capacities which the dilating heate hath made that else would be empty, and to supply the roomes of those which the heate continually sendeth vpwardes: for the moysture of the roote, hath a continuity with that in the earth, and therefore, they adhere together (as in a pumpe; or rather, as in filtration) and do follow one an other when any of them are in motion, and still the next must needes come in, and fill the roome, where it findeth an empty space immediate to it. The, like of which happeneth to the ayre when we breath; for our lunges being like a bladder; when we open them the ayre must needes come in, to fill that capacity which else would be empty: and when we shutt them againe; as in a paire of bellowes we putt it out.

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This may ſuffice, concerning the primary motion of rootes: but in that of the hart; we shall find the matter not altogether ſo plaine Monſieur des Cartes following herein the ſteppes of the learned and ingenious Haruey, who hath inuented and teacheth that curious and excellent doctrine of the circulation of the bloud; (as indeede, what ſecret of nature can be hidden from ſo sharpe a witt, when he applyeth himſelfe to penetrate into the bottome of it:) explicateth the matter much after this ſort. That the hart, within, in the ſubſtance of it, is like a hollow cauerne; in whoſe bottome, were an hoat ſtone; on which should droppe as much liquour as the fiery ſtone could blow into ſmoake; and this ſmoake or ſteame, should be more then the caue could containe; wherefore it muſt breake out; which to do, it preſſeth on all ſides to gett an iſſue or dore to lett it out: it findeth of two ſortes; but only, one kind of them, will ſerue it for this purpoſe; for the one ſort of theſe dores, openeth inwardes, the other, outwardes: which is the cauſe that the more it ſtriueth to gett out, the faſter it shutteth the doores of the firſt kinde; but by the ſame meanes, it beateth backe the other dores; and ſo getteth out. 2. Monſieur des Cartes his opinion touching the motion of the hart.

Now when it is gone quite out of this cauerne; and conſequently leaueth it to its naturall diſpoſition; whereas before it violently ſtretched it out; and by doing ſo kept cloſe the dores that open inwardes: then all the partes of it beginne to ſlacken; and thoſe dores giue way vnto new liquour to droppe in anew; which the heate in the bottome of the hart, rarifyeth againe into ſmoake as before. And thus he conceiueth the motion of the hart to be made; taking the ſubſtance of it to be (as I may ſay) like vnto limber leather, which vpon the filling of it with bloud and ſteame, openeth and dilateth it ſelfe; and att the going of it out, it shrinketh together like a bladder.

But I doubt, this explication will not go through the difficulty, for firſt both Galen and Doctor Haruey do shew, that as ſoone as the bloud is come into the hart, it contracteth it ſelfe: which agreeth not with Monſieur des Cartes his ſuppoſition; for in his doctrine, there appeareth no cauſe why it should contract it ſelfe when it is full: but contrariwiſe, it should goe on dilating it ſelfe, vntill enough of the bloud which droppeth into the hart, were conuerted into ſteame, to force the dores open; that ſo, it may gaine an iſſue thence, and a paſſage into the body. 3. The former opinion reiected.

Next; Monſieur des Cartes ſuppoſeth that the ſubſtance of the hart is like a bladder, which hath no motion of it ſelfe; but openeth and shutteth, according as what is within it, ſtretcheth it out, or permitteth it to shrinke and fall together againe. Whereas, Doctor Haruey prooueth that when it is full, it compreſſeth it ſelfe by a quicke and ſtrong motion, to expell that which is in it: and that when it is empty, it returneth to its naturall dilatation, figure and ſituation, by the ceaſing of that agents working, which cauſed its motion. Whereby it appeareth to be of ſuch a fibrous ſubſtance, as hath a proper motion of its owne.

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Thirdly; I see not how this motion can be proportionall: for the hart must needes open and be dilated, much faster then it can be shutt and shrinke together; there being no cause putt to shutt it and to bring it to its vtmost periode of shrinking; other then the going out of the vapour, whereby it becometh empty: which vapour not being forced by any thing but by its owne inclination; it may peraduenture, att the first when there is aboundance of it, swell and stretch the hart forcibly out; but after the first impulse and breach of some part of it out of the cauerne that encloséd it; there is nothing to driue out the rest, which must therefore steame very leisurely out.

Fourthly; what should hinder the bloud from coming in, before the hart be quite empty and shrunke to its lowest pitch? For as soone as the vapour yeildeth within, new bloud may fall in from without; and so keepe the hart continually dilated, without euer suffering it to be perfectly and completely shutt.

Fifthly; the hart of a viper layed vpon a plate in a warme place will beate 24. houres; and much longer, if it be carefully taken out of its body, and the weather be warme and moyst: and it is cleare, that this is without succession of bloud to cause the pulses of it. Likewise, the seuered mẽbers of liuing creatures, will stirre for some time after they are parted from their bodies: and in them, we can suspect no such cause of motion.

Sixthly; in Monsieur des Cartes his opinion, the hart should be hardest when it is fullest; and the eruption of the steame out of it, should be strongest att the beginning: whereas experience sheweth, that it is softest when it is att the point of being full; and hardest when it is att the point of being empty; and the motion strongest, towardes the end.

Seuenthly; in Monsieur des Cartes his way, there is no agent or force strong enough to make bloud gush out of the hart: for if it be the steame only that openeth the dores, nothing but it will goe out; and the bloud will still remaine behind, since it lyeth lower then the steame, and further from the issue that letteth it out: but Doctor Harucy findeth by experience (and teacheth how to make this experience) that when a wound is made in the hart, bloud will gush out by spurtes att euery shooting of the hart.

And lastly; if Monsieur des Cartes his supposition were true, the arteries would receiue nothing but steames; whereas it is euident that the chiefe filler of them is bloud.

4. The Authors opinion concerning the motion of the hart.

Therefore we must enquire after an other cause of this primary motion of a sensitiue creature, in the beatings of its hart. Wherein, we shall not be obliged to looke farre; for seeing we find this motion and these pulsations, in the hart when it is seperated from the body: we may boldely and safely conclude, that it must of necessity be caused by something that is within the hart it selfe. And what can that be else, but heate or spirits imprisoned in a tough viscous bloud; which it can not so presently breake through to gett out; and yet can stirre within it, and lift it vp?

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The like of which motion may be obſerued, in the heauing vp, and ſinking downe againe of looſe moulde throwne into a pitte, into which much ordure hath been emptied. The ſame cauſe, of heate in the earth, maketh mountaines and ſandes to be caſt vp in the very ſea: ſo, in frying, when the panne is full of meate, the bubbles riſe and fall att the edges: treacle, and ſuch ſtrong compounded ſubſtances; whiles they ferment, do lift themſelues vp, and ſinke downe againe, after the ſame manner as the vipers hart doth: as alſo do the bubbles of barme, and muſte of wine: and short endes of lute ſtringes baked in a iuicy pye, will att the opening of it mooue in ſuch ſort, as they who are ignorant of the feate will thinke there are magots in it: and a hoat loafe, in which quicke-ſyluer is encloſed, will not only moue thus; but will alſo leape about, and skippe from one place to an other, like the head or limbe of an animal (very full of ſpirits) newly cutt off from its whole body.

And that this is the true cauſe of the harts motion, appeareth euidently. Firſt, becauſe this vertue of mouing, is in euery part of the hart; as you will plainely ſee if you cutt into ſeuerall pieces a hart, that conſerueth its motion long after it is out of the animals belly: for euery piece will moue; as Doctor Haruey aſſureth vs by experience, and I my ſelfe haue often ſeene, vpon occaſion of making the greate antidote, in which vipers harts is a principall ingredient. Secondly the ſame is ſeene in the auricles and the reſt of the hart; whoſe motions are ſeuerall; though ſo neere together, that they can hardly be diſtinguished. Thirdly; Doctor Haruey ſeemeth to affirme that the bloud which is in the eares of the hart, hath ſuch a motion of it ſelfe, precedent to the motion of the eares it is in: and that this vertue remaineth in it for a litle ſpace after the eares are dead. Fourthly; in touching a hart which had newly left mouing, with his fingar wetted with warme ſpittle, it began to moue againe, as teſtifying that heate and moyſture, made this motion. Fifthly; if you touch the vipers hart ouer with vinegar, with ſpiritt of wine, with sharpe white wine, or with any piercing liquour; it preſently dyeth: for the acuteneſſe of ſuch ſubſtances, pierceth through the viſcous bloud, and maketh way for the heate to gett out.

But this firſt mouer of an animal, muſt haue ſomething from without to ſtirre it vp; elſe, the heate would lye in it, as if it were dead; and in time would become abſolutely ſo. In egges, you ſee this exteriour mouer, is the warmeth of the henne hatching thē. And in Embryōs; it is the warmeth of the mothers wombe. But when in either of them, the hart is cōpletely formed, and is encloſed in the breſt; much heate is likewiſe encloſed there, in all the partes neere about the hart; partly made by the hart it ſelfe; and partly cauſed by the outward heate, which helped alſo to make that in the hart: and then although the warmeth of the henne or of the mothers wombe, do forſake the hart; yet this ſtirreth vp the natiue heate within the hart and keepeth it in motion, and maketh it feede ſtill vpon now fewell, as faſt as that which it worketh vpon decayeth.

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5. The motion of the hart dependeth originally of its fibers irrigated by bloud.

But to expreſſe more particularly how this motion is effected; we are to note, that the hart hath in the ventricles of it, three ſortes of fibers: the firſt go long wayes or are ſtraight ones, on the ſides of the ventricles from the thicke baſis of the hart, towardes the litle tippe or cone of it: the ſecond, go croſſe or roundwayes about the ventricles within the hart: and the third, are tranſuerſall or thwart ones. Next we are to remember, that the hart is fixed to the body by its baſe; and hangeth looſe att the cone. Now then, the fibers being of the nature of ſuch thinges as will ſwell and grow thicker by being moiſtened, and conſequently shrinke vp in length and grow shorter, in proportion to their ſwelling thicker (as you may obſerue in a looſewrought hempen roape) it muſt of neceſſity follow, that when the bloud falleth into the hart (which is of a kind of ſpungye ſubſtance) the fibers being therewith moyſtened, they will preſently ſwell in roundneſſe and shrinke in length.

Next we are to note, that there is a double motion in the hart: the one of opening, which is called, Diaſtole; the other, of shutting, which is termed Syſtole. And although Doctor Haruey ſeemeth to allow the opening of the hart to be no motion; but rather a relenting from motion; neuertheleſſe (me thinketh) it is manifeſt, that it is not only a cõplete motion, but in a manner the greater motion of the two, though indeede the leſſe ſenſible; becauſe it is performed by litle and litle; for in it the hart is drawne by violence frõ its naturall poſitiõ; which muſt be (as it is of all heauy thinges) that by which it approacheth moſt to the cẽter of gratity; and ſuch a poſition we ſee it gaineth by the shutting of it.

Now to declare how both theſe motions are effected, we are to conſider how att the end of the ſyſtole the hart is voyded and cleanſed of all the bloud that was in it; whence it followeth, that the weight of the bloud which is in the auricles, preſſing vpon the *Valuulas* or dores that open inwardes, maketh its way by litle and litle into the ventricles of the hart where it muſt neceſſarily ſwell the fibers; and they being ſwelled muſt needes draw the hart into a roundish and capacious figure; which the more it is done, the more bloud cometh in; and with greater violence. The following effect of which muſt be, that the weight of the bloud ioyned to the weight of the hart it ſelfe, and particularly of the *conus* or tippe (which is more ſolide and heauy in proportion to its quantity, then the reſt of the hart) muſt neceſſarily ſett the hart into the naturall motion of deſcending according to its grauity: the which conſequently, is performed by a liuely ierke, whereby it cometh to paſſe that the tippe of our hart, doth as it were ſpring vp towardes our breſt: and the bloud is ſputted out by other *Valuulæ* (that open outwardes) which are aptly diſpoſed to be opened vpon ſuch a motion, and do conuey it to the arteries.

In the courſe of which motion, we may note how the figure of our hart contributeth to its ſpringing vp towardes our breſt; for the line of diſtance

distance which is betweene the basis and the tippe being longer on that side which is towardes the backe, then on the other which is towardes the brest; it must happen that when the hart shutteth and straighteneth it selfe, and thereby extendeth it selfe to its length, the tippe will butte out forewardes towardes the brest.

6. An obiection answered against the former doctrine.

Against this doctrine of the motion, and of the systole and diastole of the hart, it may be obiected, that beasts harts do not hang like a mans hart, straight downewardes; but rather horizontally; and therefore this motion of grauity can not haue place in them: neuertheless, we are sure they beate, and do open and shutt, regularly. Besides, if there were no other cause but this of grauity for the motion of a mans hart, it would follow that one who were sett vpon his head or hung by his heeles, could not haue the motion of his hart: which, posture neuertheless, we see men remaine in for a pretty while, without any extreme preiudice.

But these difficulties are easily answered; for whether beasts harts do lye directly horizontally, or whether, the basis be fastened some what higher then the tippe reacheth, and so maketh their hart hang inclining downewardes; still the motion of grauity hath its effect in them. As wee may perceiue in the hart of a viper lying vpon a plate, and in any other thing that of it selfe swelleth vp, and straight againe sinketh downe: in which we can not doubt, but that the grauity fighting against the heate, maketh the eleuated partes to fall, as the heate maketh them rise.

And as for the latter; it is euident that men can not stay long in that posture without violent accidents; and in any litle while we see that the bloud cometh into their face and other partes which naturally are situated higher; but by this position become lower then the hart: and much time is not required, to haue them quite disordered and suffocated; the bloud passing through the hart with too much quickenesse, and not receiuing due concoction there; and falling thence in too great aboundance into places that can not with conueniency entertayne it.

But you will insist, and aske, whether in that posture the hart doth moue or no, and how? And to speake by guesse in a thing I haue not yet made experiences enough to be throughly informed in; I conceiue without any great scrupule that it doth moue. And that it happeneth thus; that the hart hanging somwhat loose, must needes tũble ouer, and the tippe of it leane downewardes some way or other; and so lye in part like the hart of a beast; though not so conueniently accommodated: and then the heate which maketh the viscous bloud that is in the substance of the hart to ferment will not faile of raising it vp: whereupon, the weight of that side of the hart, that is lifted vp, will presently presse it downe againe. And thus, by the alternatiue operations of these causes, the hart will be made to open, and shutt it selfe, as much as is necessary for admitting and thrusting out, that litle and disorderly

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coming bloud, which maketh its course through it, for that litle space wherein the man continueth in that position.

7. The circulatiō of the bloud, and other effects that follow the motion of the hart.

Now from these effects wrought in the hart by the moystening of the fibers; two other effects do proceed: the one is, that the bloud is pushed out of euery corner of the hart with an impetuousnesse or velocity. The other is, that by this motion the spirits, which are in the ventricles of the hart, and in the bloud that is euen then heated there, are more and deeper pressed into the substance of the hart; so that you see, the hart imbibeth fresh vigour, and is strengthned with new spirits, whiles it seemeth to reiect that which should strengthen it.

Againe, two other effects follow this violent eiection of the bloud out of the hart. The one is, that for the present, the hart is entirely cleansed of all remainders of bloud none being permitted to fall backe to annoy it. The other is, that the hart finding it selfe dry; the fibers do relent presently into their naturall positiō and extensiō, and the valuulæ that open inwardes, fall flatt to the sides of the ventricles, and consequently, new bloud droppeth in. So that in conclusiō, we see, the motion of the hart, dependeth originally of its fibers irrigated by the bloud: and not from the force of the vapour as Monsieur des Cartes supposeth.

This motion of the hart, driueth the bloud (which is warmed and spiritualised, by being boyled in this furnace) through due passages into the arteries, which frō thē runneth into the veines, and is a maine cause of making and nourishing other partes; as the liuer, the lūgs, the braines, and whatsoeuer else dependeth of those veines and arteries through which the bloud goeth. Which being euer freshly heated, and receiuing the tincture of the harts nature by passing through the hart; whereseoeuer it stayeth and curdleth, it groweth into a substance of a nature conformable to the hart; though euery one of such substances, be of exceeding different conditions in themselues, the very grosseſt excrements, not being excluded from some participation of that nature.

But if you desire to follow the bloud all along euery steppe, in its progresse from the hart round about the body, till it returne backe againe to its center, Doctor Haruey who most acutely teacheth this doctrine, must be your guide. He will shew you how it issueth from the hart by the arteries; from whence it goeth on warming the flesh, vntill it arriue to some of the extremities of the body: and by then it is growne so coole (by long absence from the fountaine of its heate; and by euaporating its owne stocke of spirits, without any new supply) that it hath neede of being warmed a new; it findeth it selfe returned backe againe to the heart, and is there heated againe, which returne is made by the veines, as its going forwardes, is performed only by the arteries.

And were it not for this continuall circulation of the bloud and this new heating it in its proper cauldron, the hart; it could not be auoyded, but that the extreme partes of the body would soone grow cold and dye. For flesh, being of it selfe of a cold nature (as is apparent in dead flesh)

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and being kept warme, meerely by the bloud that bedeweth it; and the bloud likewise being of a nature that soone groweth cold, and congealeath, vnlesse it be preserued in due temper by actuall heate working vpon it: how can we imagine that they two singly, without any other assistance, should keepe one an other warme (especially in those partes, that are farre distant from the hart) by only being together? Surely, we must allow the bloud, (which is a substance fitt for motion) to haue recourse backe to the hart, (where only it can be supplyed with new heate and spirits) and from thence be driuen out againe by its pulses or stroakes; which are his shuttinges. And as fast as it flyeth out, (like a reeking thicke steame, which riseth from perfumed water falling vpon a heated panne) that which is next before it, must fly yet further on, to make way for it; and new arteriall blould still issuing forth att euery pulse, it must still driue on what issued thence the last precedent pulse, and that part must presse on what is next before it. And thus it fareth with the whole masse of blould; which hauing no other course, but in the body, it must att length runne round, and by new vessels (which are the veines) returne backe vnto the place from whence it issued first: and by that time it cometh thither, it is growne coole and thicke, and needeth a vigorous restauration of spirits and a new rarifying; that then, it may warme the flesh, it passeth againe through: without which it would soddainely grow stone cold; as is manifest, if by tying or cutting the arteries, you intercept the blould, which is to nourish any part: for then that part, groweth presently cold and benummed.

8. Of Nutrition.

But referring the particulars of this doctrine vnto Doctor Haruey (who hath both inuented and perfected it) our taske in hand calleth vpon vs to declare in common the residue of motions that all liuing creatures agree in. How generation is performed, we haue determined in the past discourse. Our next consideration then ought to be of Nutrition and Augmentation. Betweene which there is very litle difference in the nature of their action; and the difference of their names is grounded more vpon the different result in the periode of them, then vpon the thing it selfe: as will by and by appeare. Thus then is the progresse of this matter: as soone as a liuing creature is formed, it endeauoureth straight to augment it selfe; and employeth it selfe only about that; the partes of it being yet too yong and tender, to performe the other functions which nature hath produced them for. That is to say; the liuing creature, att its first production, is in such a state and condition as it is able to do nothing else, but (by meanes of the greate heate that is in it) to turne into its owne substance the aboundance of moysture that ouerfloweth it.

They who are curious in this matter, do tell vs that the performance of this worke consisteth in fiue actions; which they call, Attraction, Adhesion, Concoction, Assimilation and Vnition. The nature of attraction, we haue already declared when we explicated, how the hart

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and the roote ſendeth iuice into the other partes of the animal or plant: for they abounding in themſelues with inward heate, and beſides that, much other circumſtant heate working likewiſe vpon them; it can not be otherwiſe, but that they muſt needes ſucke and draw into them, the moyſture that is about them.

As for adheſion, the nature of that is likewiſe explicated, when we shewed, how ſuch partes as are moyſt, but eſpecially aereall or oyly ones (ſuch as are made by the operation of a ſoft and continuall heate) are catching and do eaſily ſticke vnto any body they happen to touch: and how a litle part of moyſture betweene two dry partes, ioyneth them together. Vpon which occaſion, it is to be noted that partes of the ſame kind do ioyne beſt together: and therefore the pouder of glaſſe is vſed to cimēt broken glaſſe with all (as we haue touched ſome where aboue:) and the pouder of marble to ciment marble with; and ſo of other bodies: in like manner, Alchymiſtes find no better expedient to extract a ſmall proportion of ſiluer mixed with a great one of gold, then to putt more ſiluer to it: nor any more effectuall way to gett out the hart, or tincture, or ſpirits of any thing they diſtill or make an extract of, then to infuſe its owne flegme upon it, and to water it with that. Now whether the reaſon of this be, that continuity, becauſe it is an vnity, muſt be firmeſt betweene parts that are moſt conformable to one an other, and conſequently, are moſt one among themſelues; or whether it be for ſome other hidden cauſe, belongeth not to this place to diſcourſe: but in fine ſo it is. And the adheſion is ſtrongeſt of ſuch partes as are moſt conformable to that which needeth encreaſe and nourishment; and that is made vp by the other three actions.

Of which, concoction is nothing elſe but a thickening of that iuice which already ſticketh to any part of the animals body, by the good digeſtion that heate maketh in it. And aſſimilation, is the effect of concoction: for this iuice being vſed in the ſame manner, as the firſt iuice was, that made the part, wherevnto this is to be ioyned; it can not chooſe but become like vnto it in ſubſtance. And then, there being no other ſubſtance betweene, it is of it ſelfe vnited vnto it without any further helpe.

9. Of Augmentation.

Hitherto, this action belongeth to nutrition. But if on the one ſide, the heate and ſpiritualit y of the bloud; and on the otherſide the due temper and diſpoſition of the part be ſuch, as the bloud is greedily ſucked into the part, which thereby ſwelleth to make roome for it, and will not lett it go away, but turneth it into a like ſubſtance as it ſelfe is; and in greater quantity then what is conſumed and decayeth continually by tranſpiration: then this action is called likewiſe augmentation. Which Galen explicateth by a ſport the boyes of Ionia vſed; who were accuſtomed to fill a bladder with wind; and when they could force no more into it, they would rubbe the bladder, and after rubbing of it, they found it capable of receiuing new breath: and ſo they would proceed on,

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on, vntill their bladder were as full as by vse they knew it could be made. Now (saith he) nature doth the like, by filling our flesh, and other partes with bloud; that is to say, it stretcheth the fibers: but she hath ouer and aboue a power which the boyes had not; namely to make the fibers as strong after they are stretched to their vtmost extension, as they were before they were extended: whence it happeneth that she can extend them againe, as well as att the first; and this without end, as farre as concerneth that part.

The reason whereof is, because she extendeth them by meanes of a liquour which is of the same nature, as that whereof they were made att the first: and from thence it followeth, that by concoction that liquour settleth in the partes of the fibers which haue most neede; and so maketh those partes as great in the length they are extended vnto, as they were in their shortnesse, before they were drawne out. Whereby the whole part of the animal, wherein this happeneth, groweth greater: and the like being done in euery part, as well as in any one single one, the whole animal becometh bigger; and is in such sort augmented.

10. Of death and sickenesse.

Out of all which discourse, we may collect that in the essentiall composition of liuing creatures, there may peraduenture be a physicall possibility for them to continue alwayes without decay; and so, become immortall, euen in their bodies, if all hurtfull accidents coming from without might be preuented. For seeing that a man, besides the encrease which he maketh of himselfe, can also impart vnto his children a vertue, by which they are able to do the like, and to giue againe vnto theirs as much as they receiued from their fathers: it is cleare, that what maketh him dye, is no more the want of any radicall power in him, to encrease or nourish himselfe; then in fire, it is the want of power to burne, which maketh it goe out. But it must be some accidentall want, which Galen attributeth chiefely to the dryenesse of our bones, and sinewes &c. as you may in him see more att large; for dryenesse, with density, alloweth not easy admittance vnto moysture: and therefore, it causeth the heate which is in the dry body, eyther to euaporate or to be extinguished: and want of heate, is that, from whence the failing of life proceedeth: which he thinketh can not be preuented by any art or industry.

And herein, God hath expressed his great mercy and goodnesse towardes vs: for seeing that by the corruption of our owne nature, we are so immersed in flesh and bloud as we should for euer delight to wallow in their myre without raysing our thoughts att any time aboue that low and brutall condition: he hath engaged vs by a happy necessity, to thinke of and to prouide for a nobler and farre more excellent state of liuing that will neuer change or end.

In pursuance of which ineuitable ordinance; man (as if he were growne weary and out of loue with this life; and scorned any terme in his farme here, since he can not purchase the fee simple of it) hasteneth on his death by his vnwary and rash vse of meates, which poyson his

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bloud: and then, his infected bloud passing through his whole body, must needes in like manner, taynt it all att once. For the redresse of which mischiefe, the assistance of Physike is made vse of: and that, passing likewise the same way purifyeth the bloud, and recouereth the corruption occasioned by the peccant humour; or other whiles gathering it together, it thrusteth and carryeth out that euill gueſt by the passages contriued by nature to bisburden the body of vnprofitable or hurtfull superfluities.

THE SEVEN AND TWENTIETH CHAPTER.

Of the motions of sense; and of the sensible qualities in generall; and in particular of those which belong to Touch, Taste, and Smelling.

1. The cõnexion of the subsequent chapters with the precedent.

HAuing thus brought on the course of nature as high as liuing creatures (whose chiefe speciesses or diuision, is those that haue sense) and hauing declared the operations which are common to the whole tribe of them, which includeth both plants and animals: it is now time we take a particular view of those, whose action, and passion, is the reason why that chiefe portion of life is termed sensitiue; I meane the senses, and the qualities, by which the outward world cometh into the liuing creature, through his senses. Which when we shall haue gone through, we shall scarcely haue left any qualities among bodies, to pleade for a spirituall manner of being or working; that is, for a selfe entity, and instantaneous operation: which kind of thinges and properties, vulgar Philosophy is very earnest to attribute vnto our senses: with what reason, and vpon what ground lett vs now consider.

2. Of the senses and sensible qualities in generall. And of the end for which they serue.

These qualities are reduced to fiue seuerall heades; answerable to so many different wayes, whereby we receiue notice of the bodies that are without vs. And accordingly, they constitute a like number of different senses: of euery one of which, we will discourse particularly, when we haue examined the natures of the qualities that effect them. But now, all the consideration we shall need to haue of them, is only this; that it is manifest the organes in vs by which sensible qualities do worke vpon vs, are corporeall, and are made of the like ingredients as the rest of our body is: and therefore, must of necessity be lyable to suffer euill and to receiue good (in such sort as all other bodies do) from those actiue qualities which make and marre all thinges within the limits of nature. By which termes of Euill and Good, I meane, those effects that are auerse or conformable to the particular nature of any thing: and thereby do tend to the preseruation or destruction, of that Indiuiduall.

Now we receiuing from our senses, the knowledge that we haue of thinges without vs; do giue names vnto them according to the passions

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passions and affections, which those thinges cause in our sense: which being the same in all mankind (as long as they are considered in cõmon, and that their effects are looked vpon in grosse) all the world agreeth in one notion and in one name of the same thing; for euery man liuing is affected by it, iust as his neighbour is, and as all men else in the world are. As for example; heate or cold worketh the same feeling in euery man composed of flesh and bloud; and therefore, whosoeuer should be asked of them, would returne the same answere, that they cause such and such effects in his sense, pleasing or displeasing to him, according to their degrees, and as they tend to the good or euill of his whole body.

But if we descend to particulars, we shall find, that seuerall men of differing constitutions, do frame different notions of the same thinges, according as they are conformable or disagreeing to their natures: and accordingly they giue them different names. As when the same liquor is sweete to some mens taste; which to an others appeareth bitter: one man taketh that for a purfume; which to an other, is an offensiue smell: in the Turkesh bathes; (where there are many degrees of heate in diuers roomes, through all which the same person vseth to passe, and to stay a while in euery one of them, both att his entrance and going out, to season his body by degrees, for the contrary excesse he his going vnto) that seemeth chilly cold att his returne; which appeared melting hoat att his going in; as I my selfe haue often made experience in those countries: beauty and louelinesse will shine to one man, in the same face, that will giue auersion to an other. All which proclaymeth, that the sensible qualities of bodies, are not any positiue reall thing, consisting in an indiuisible, and distinct from the body it selfe; but are meerely the very body, as it affecteth our senses: which to discouer how they do it, must be our labour here.

Lett vs therefore beginne, with considering the difference, that is betweene sensible and insensible creatures. These latter, do lye exposed the mercy of all outward agents that frõ time to time (by the cõtinuall motion which all thinges are in) do come within distance of working vpon them: and they haue no power to romoue themselues from what is auerse to their nature; nor to approach neerer vnto what comforteth it. But the others hauing within themselues a principle of motion (as we haue already declared) whensoeuer such effects are wrought vpon them, as vpon the others; they are able, vpon their owne account and by their owne action, to remoue themselues from what beginneth to annoy them, and to come neerer vnto what they find a beginning of good by.

These impressions, are made vpon those partes of vs, which we call the organes of our senses; and by them, do giue vs seasonable aduertisements and knowledges whereby we may gouerne and order to the best aduantage, our litle charge of a body, according to the tune or warninges of change in the great circumstant body of the world, as

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farre as it may concerne ours. Which how it is done, and by what steppes it proceedeth, shall be in the following discourse layed open.

Of this great machine that enuironneth vs, we who are but a small parcell, are not immediately concerned in euery part of it. It importeth not vs, for the conseruation of our body, to haue knowledg of other partes then such as are within the distance of working vpon vs: those only within whose sphere of actiuity we are planted, can offend or aduantage vs: and of them; some are neere vs; others, further from vs. Those that are next vnto vs; we discerne (according as they are qualifyed) eyther by our touch, or by our tast, or by our smelling; which three senses, do manifestly appeare to consist in a meere gradation of more or lesse grosse; and their operations are leuelled to the three Elements that presse vpon vs; earth, water, and ayre. By our other two senses (our hearing and our seeing) we haue notice of thinges further off: and the agents which worke vpon them, are of a more refined nature.

3. Of the sense of touching: and that both it and its qualities are bodies.

But we must treat of them all in particular: and that which we will beginne with, shall be the touch, as being the grosseſt of them, and that which conuerseth with none, but the most materiall and massye obiects. We see it dealeth with heauy consistent bodies; and iudgeth of them by coniunction vnto them, and by immediate reception of something from them. And according to the diuers impressions they make in it; it distinguisheth them by diuers names; which (as we said of the qualities of mixed bodies) are generally reduced to certaine payres; as hoat and cold, wett and drye, soft and hard, smooth and rough, thicke and thinne, and some others of the like nature; which were needeleſse to enumerate, since we pretend not to deliuer the science of them, but only to shew that they and their actions, are all corporeall.

And this is sufficiently euident, by meere repeating but their very names; for it is plaine, by what we haue already said; that they are nothing else but certaine affections of quantity, arising out of different degrees of rarity and density compounded together. And it is manifest by experience, that our sense receiueth the very same impressions from them, which an other body doth; for our body, or our sense will be heated by fire; and will also be burned by it, if the heate be too great, as well as wood: it will be constipated by cold water, moystened by humide thinges, and dryed by dry bodies, in the same manner as any other body whatsoeuer; likewise, it may in such sort as they, be wounded and haue its continuity broken by hard thinges; be pleased and polished, by those that are soft and smooth; be pressed by those that are thicke and heauy; and be rubbed by those that are rugged &c.

So that those masters, who will teach vs that the impressions vpon sense are made by spirituall or spiritelike thinges or qualities; which they call intentionall species, must labour att two workes: the one to make it appeare that there are in nature such thinges as they would persuade vs; the other to proue that these materiall actions we speake of are not

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able to performe thoſe effects, for which the ſenſes are giuen vnto liuing creatures. And vntill they haue done that, I conceiue we should be much too blame to admitt ſuch thinges, as we neyther haue ground for in reaſon, nor can vnderſtand what they are. And therefore, we muſt reſolue to reſt in this beliefe, which experience breedeth in vs: that theſe bodies worke vpon our ſenſes no other wayes then by a corporeall operation; and that ſuch a one is ſufficient for all the effects we ſee proceede from them: as in the proceſſe of this diſcourſe we shall more amply declare.

4. Of the taſt and its qualities: that they are bodies.

The element immediately next to earth in groſſeneſſe, is water. And in it is the exerciſe of our taſt, our mouth being perpetually wett within: by meanes of which moyſture, our tongue receiueth into it, ſome litle partes of the ſubſtance which we chewe in our teeth, and which paſſeth ouer it. You may obſerue how, if we take any herbe or fruite; and hauing chopped or beatē it ſmall, we thē putt it into a wooden dish of water and do ſqueeſe it a litle; the iuice, communicating and mingling it ſelfe with; the water, infecteth it with the taſt of it ſelfe, and remaining a while in the bowle ſinketh by litle and litle into the very pores of the wood: as is manifeſt, by its retaining a long time after, the taſt and ſmell of that herbe. In like manner, nature hath taught vs, by chewing our meate, and by turning it into our mouthes and preſſing it a litle (that we may the more eaſily ſwallow it) to imbue our ſpittle with ſuch litle partes as eaſily diffuſe themſelues in water. And then our ſpittle being continuate to the moyſture, which is within our tongue, (in ſuch ſort as we declared of the moyſture of the earth, that ſoaketh into the roote of a plant) and particularly in the ſinewes of it; muſt of neceſſity affect thoſe litle ſenſible ſtringes with the qualities which theſe petty bodies, mixed euery where with the moyſture, are themſelues imbued withall.

And if you aske what motions or qualities theſe be: Phyſitians (vnto whom it belongeth moſt particularly to looke into them) will tell you, that ſome dilate the tongue more, and ſome leſſe; as if ſome of theſe litle bodies had an aereall, and others a watry diſpoſition: and theſe two, they expreſſe by the names of ſweete and fatty. That ſome, do contract and draw the tongue together; as choaky and rough thinges do moſt; and next to them, crabby and immature sharpeneſſe. That ſome do corrode and pierce the tongue; as ſalt and ſoure thinges. That bitter thinges do ſearch the outſide of it, as if they ſwept it: and that other thinges, do as it were pricke it; as ſpices and hoat drinkes. Now all theſe are ſenſible materiall thinges; which admitt to be explicated clearely, by the varieties of rarity and denſity concurring to their compoſitions: and are ſo proportionable to ſuch materiall inſtruments as we can not doubt but that they may be throughly declared by our former principles.

5. That the ſmell and its qualities are reall bodies.

The next element aboue water, is ayre; which our noſethrilles, being our inſtrument to ſucke in, we can not doubt but what affecteth a man by his noſe, muſt come vnto him in breath or ayre. And as humidity

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receiueth groſſer and weightier partes; ſo thoſe which are more ſubtile and light, do riſe vp into the ayre: and theſe we know attaine vnto this lightneſſe, by the commixtion of fire, which is hoat and dry. And therefore, we can not doubt, but that the nature of ſmell is more or leſſe tending to heate and drought: which is the cauſe that their commixtion with the braine, proueth comfortable vnto it; becauſe of its owne diſpoſition it is vſually ſubiect to be too moyſt and too cold.

Whether there be any immediate inſtrument of this ſenſe, to receiue the paſſion or effect, which by it, other bodies make vpon vs; or whether the ſenſe it ſelfe, be nothing but a paſſage of theſe exhalations and litle bodies vnto the braine, fittly accommodated to diſcerne, what is good, or hurtfull for it, and accordingly to moue the body to admitt or reiect them; importeth not vs att preſent to determine: lett Phyſitians and Anatomiſtes reſolue that queſtion; whiles it ſufficeth vs to vnderſtand, that the operations of bodies by odours vpon our ſenſe, are performed by reall and ſolide partes of the whole ſubſtance; which are truly materiall, though very litle, bodies; and not by imaginary qualities.

6. Of the conformity betwixt the two ſenſes of ſmelling and taſting.

And thoſe bodies, when they proceed out of the ſame thinges that yield alſo taſtiue particles, (although without ſuch materiall violence, and in a more ſubtile manner) muſt of neceſſity haue in them the ſame nature, which thoſe haue that affect the taſte; and they muſt both of them, affect a man much alike, by his taſte and by his ſmell: and ſo, are very proportionate to one an other; excepting in thoſe properties which require more cold or liquidity, then can well ſtand with the nature of a ſmell. And accordingly, the very names which men haue impoſed, to expreſſe the affections of both do many times agree: as ſauour, which is common both to the ſmell and to the taſte; and ſweete likewiſe: the ſtrongeſt of which, we ſee oftentimes do make themſelues knowne, as well by the one as by the other ſenſe: and eyther of them in exceſſe, will turne a mans ſtomake. And the Phyſitians that write of theſe ſenſes find them very conformable: and therefore it happeneth that the looſing of one of them, is the loſſe alſo of the other.

And experience teacheth vs in all beaſtes, that the ſmell is giuen vnto liuing creatures, to know what meates are good for them, and what are not. And accordingly, we ſee them ſtill ſmell for the moſt part, att any vnknowne meate before they touch it; which ſeldome fayleth of informing them rightly: nature hauing prouided this remedy againſt the gluttony, which could not chooſe but follow the conuenient diſpoſition and temper of their partes and humors; through which they often ſwallow their meate greedily and ſoddainely without expecting to trye it firſt by their taſte. Beſides that many meates are ſo ſtrong, that their very taſting them after their vſuall manner, would poyſon or att the leaſt greately annoy them: and therefore nature hath prouided this ſenſe to preuent their taſte; which being farre more ſubtile then

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then their taſte; the ſmall atomes by which it is performed, are not ſo very noxious to the health of the animal, as the other groſſer atomes are.

And doubtleſſely, the like vſe men would make of this ſenſe, had they not on the one ſide better meanes then it to know the qualities of meates: and therefore, this is not much reflected vpon. And on the other ſide, were they not continually ſtuffed and clogged with groſſe vapours of ſteamy meates, which are dayly reeking from the table and their ſtomakes; and permitt not purer atomes of bodies, to be diſcerned; which require cleare and vninfected organes to take notice of them. As we ſee it fare with dogges; who haue not ſo true and ſenſible noſes, when they are high fed, and lye in the kitchin amiddeſt the ſteames of meate; as when they are kept in their kennell, with a more ſpare diett fitt for hunting. 7. The reaſō why the ſenſe of ſmelling is not ſo perfect in man as in beaſtes: with a wonderfull hiſtorie of a man who could wind a ſent as well as any beaſt.

One full example, this age affordeth vs in this kind, of a man whoſe extremity of feare, wrought vpon him to giue vs this experiment. He was borne in ſome village of the country of Liege: and therefore among ſtrangers, he is knowne by the name of Iohn of Liege. I haue beene informed of this ſtory by ſeuerall (whom I dare confidently beleeue) that haue had it from his owne mouth; and haue queſtioned him with great curioſity, particularly about it.

When he was a litle boy, there being warres in the country (as that State is ſeldome without moleſtations from abroad, when they haue no diſtempers att home, which is an vnſeparable effect of a countries ſituation vpon the frontiers of powerfull neighbouring Princes that are att variance) the village of whence he was, had notice of ſome vnruly ſcattered troopes that were coming to pillage them: which made all the people of the village fly haſtily with what they could carry with them, to hide themſelues in the woods: which were ſpacious enough to afford them shelter, for they ioyned vpon the foreſt of Ardenne. There they lay, till ſome of their ſcoutes brought them word, that the ſouldiers of whom they were in ſuch apprehenſion, had fired their towne and quitted it. Then all of them returned home, excepting this boy; who, it ſeemeth, being of a very timorous nature, had images of feare ſo ſtrong in his fanſie; that firſt, he ranne further into the wood then any of the reſt; and afterwardes apprehended that euery body he ſaw through the thickets, and euery voyce he heard was the ſouldiers: and ſo hidd himſelfe from his parents, that were in much diſtreſſe ſeeking him all about, and calling his name as loud as they could. When they had ſpent a day or two in vaine, they returned home without him, and he liued many yeares in the woods, feeding vpon rootes, and wild fruites, and maſte.

He ſaid that after he had beene ſome time in this wild habitation, he could by the ſmell iudge of the taſt of any thing that was to be eaten:

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and that he could att a great distance wind by his nose, where wholesome fruites or rootes did grow. In this state he continued (still shunning men with as great feare as when he first ranne away; so strong the impression was, and so litle could his litle reason master it) vntill in a very sharpe winter, that many beastes of the forest perished for want of foode; necessity brought him to so much confidence, that leauing the wild places of the forest, remote from all peoples dwellinges, he would in the eueninges steale among cattle that were fothered; especially the swine, and among them, gleane that which serued to sustaine wretchedly his miserable life. He could not do this so cunningly, but that returning often to it, he was vpon a time espyed: and they who saw a beast of so strange a shape (for such they tooke him to be; he being naked and all ouer growne with haire) beleeuing him to be a satyre, or some such prodigious creature as the recounters of rare accidents tell vs of; layed wayte to apprehend him. But he that winded them as farre off, as any beast could do, still auoyded them, till att the length, they layed snares for him; and tooke the wind so aduantagiously of him, that they caught him: and then, soone perceiued he was a man; though he had quite forgotten the vse of all language: but by his gestures and cryes, he expressed the greatest affrightednesse that might be. Which afterwardes, he said (when he had learned anew to speake) was because he thought, those were the souldiers he had hidden himselfe to auoyde, when he first betooke himselfe to the wood; and were alwayes liuely in his fansie, through his feares continually reducing them thither.

This man within a litle while after he came to good keeping and full feeding, quite lost that acuteness of smelling which formerly gouerned him in his taste; and grew to be in that particular as other ordinary men were. But att his first liuing with other people, a woman that had compassion of him to see a man so neere like a beast; and that had no language to call for what he wished or needed to haue; tooke particular care of him; and was alwayes very sollicitous to see him furnished with what he wanted: which made him so apply himselfe vnto her in all his occurrents, that whensoeuer he stood in neede of ought, if she were out of the way, and were gone abroad into the fieldes, or to any other village neere by, he would hunt her out presently by his sent, in such sort as with vs those dogges vse to do which are taught to draw dry foote. I imagine he his yet aliue to tell a better story of himselfe then I haue done; and to confirme what I haue here said of him: for I haue from them who saw him but few yeares agone, that he was an ablestrong man, and likely to last yet a good while longer.

And of an other man, I can speake assuredly my selfe, who being of a very temperate or rather spare diett, could likewise perfectly discerne by his smell the qualities of whatsoeuer was afterwardes to passe the examination of his taste, euen to his bread and beere. Wherefore to conclude it is euident both by reason, and by experience, that the obiects of our

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of our touch, our taſte, and our ſmell, are materiall and corporeall thinges, deriued from the diuiſion of quantity, into more rare and more denſe partes; and may with eaſe, be reſolued into their heades and ſpringes ſufficiently to content any iuditious and rationall man. Who if he be curious to haue further ſatisfaction in this particular (as farre as concerneth odours and ſauours) may looke ouer what Ioannes Brauus (that iuditious, though vnpolished Phyſitian of Salamanca) hath written thereof.

THE EIGHT AND TWENTIETH CHAPTER.

Of the ſenſe of hearing, and of the ſenſible quality ſound.

BVt to proceede with the reſt of the ſenſes: becauſe nature ſaw that ſome thinges came ſoddainely vpon a liuing creature; which might do it hurt, if they were not perceiued a farre off: and that other thinges were placed att diſtance from it, which would greatly helpe it, if it could come neere vnto them; ſhe found a meanes to giue vs two ſenſes more, for the diſcouery of remote thinges. The one principally and particularly to deſcry their motion. The other to marke their bulke and ſituation. i. Of the ſenſe of hearing: and that ſound is purely motiō.

And ſo to beginne with the former of theſe; we muſt needes acknowledge (after due examination of the matter) that the thing which we call ſound, is purely motion. And if it be obiected that many motions are made without any diſcernable ſound. We ſhall not make difficulty to grant it; conſidering that many motions dye, before they come to touch the eare; or elſe are ſo weake, that they are drowned by other ſtronger motions, which round about beſiege our eares in ſuch manner, that notice is not taken of theſe: for ſo it fareth in what dependeth meerely of quantity, eſpecially, concerning our ſenſes, that not euery thing of the kind, but a determinate quantity or multitude of parts of it, maketh an obiect ſenſible.

But to come cloſe to the point; we ſee that ſound, for the moſt part, is made in the ayre; and that to produce it, there is required a quicke and ſmart motion of that Element, which, of all the reſt, is the moſt moueable. And in motion, velocity or quickeneſſe, is proportionate to denſity in magnitude (as we haue att large declared.) Which maketh quantity become perceptible in bulke, as this doth in motion. And as the one conſiſteth in a greater proportion of ſubſtance to the ſame quantity; ſo the other doth in the paſſage of more partes of the medium in the ſame time.

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2. Of diuers artes belonging to the ſenſe of hearing : all which confirme that ſound is nothing but motion.

And in the moderating of this, ſuch of the liberall artes are employed, which belong to the cultiuating mans voyce; as Rhetorike, meetering, and ſinging. It is admirable how finely Galileo hath deliuered vs the conſonances of muſike towardes the end of his firſt Dialogue of motion; from the 95 page forward on : and how he hath shewed that matter clearely vnto the ſight (ſo making the eye, as well as the eare iudge of it) in motions of the water, in pendants hanging looſe in the ayre, and in permanent notes or races made vpon letton. To the moderation of the ſame, many other mechanicall artes are applyed; as the trade of bellfounders; and of all makers of muſicall inſtruments by wind, or by water, or by ſtrings.

Neyther can I ſlippe ouer without mentioning the two curious artes of Ecchoing and of whiſpering. The firſt of which, teacheth to iterate voyces ſeuerall times; and is frequently putt in practiſe by thoſe that are delighted with rarities in their gardens. And the other, sheweth how to gather into a narrow roome the motions of the ayre, that are diffuſed in a great extent; whereby, one that shall putt his eare to that place, where all the ſeuerall motions do meete, shall heare what is ſpoken ſo lowe, as no body betweene him, and the ſpeaker, can diſcerne any ſound att all. Of which kind, there are very fine curioſities in ſome churches of England: and my ſelfe haue ſeene, in an vpper roome of a capacious round tower vaulted ouerhead, the walles ſo contriued (by chance, I beleeue) that two men ſtanding att the vtmoſt oppoſite poyntes of the Diameter of it, could talke very currently and clearely with one an other; and yet none that ſtoode in the middle could heare a ſyllable. And if he turned his face to the wall and ſpoke againſt that (though neuer ſo ſoftly) the others eare, att the oppoſite poynt, would diſcerne euery word. Which putteth me in minde of a note made by one that was no frend to auricular confeſſion; vpon his occaſion of his being with me in a church that had been of a Monaſtery; where, in one corner of it, one might ſitt and heare almoſt all that was whiſpered through the whole extent of the church: who would not be perſuaded but that it was on purpoſe contriued ſo by the ſuttlety of the fryars; to the end that the Prior or ſome one of them, might ſitt there and heare whatſoeuer the ſeuerall Penitents accuſed themſelues of to their Ghoſtly fathers; ſo to make aduantage by this artifice, of what the confeſſors durſt not of themſelues immediately reueale.

He allowed better of the vſe in Rome of making voyces rebound from the toppe of the cupula of ſt: Peters in the Vatican, downe to the floore of the church; when on great dayes they make a quire of muſike goe vp to the very higheſt, part of the arch: which is into the lanterne, from whence whiles they ſing, the people below iuſt vnder it, are ſurpriſed with the ſmart ſound of their voices, as though they ſtoode cloſe by them, and yet can ſee no body from whom thoſe notes should ptoceede. And in the ſame cupula, if two men ſtand vpon the large

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cornish or bord, which circleth the bottome of it, they may obſerue the like effect, as that which I ſpoke of aboue in the round tower.

In the like manner they that are called ventriloqui, do perſuade ignorant people that the Diuell ſpeaketh from within them deepe in their belly) by their ſucking their breath inwardes in a certaine manner whiles they ſpeake: whence it followeth that their voice ſeemeth to come, not from them, but from ſomewhat elſe hidden within them; if (att the leaſt) you perceiue it cometh out of them: but if you do not, then it ſeemeth to come from a good way off.

To this art belongeth the making of ſarabatanes, or trunkes, to helpe the hearing; and of Eccho glaſſes, that multiply ſoundes, as burning glaſſes, do light. All which artes, and the rules of them, do follow the lawes of motion; and euery effect of them is to be demonſtrated by the principles and proportions of motion: and therefore, we can not with reaſon imagine them to be any thing elſe.

3. The ſame is confirmed by the effects cauſed by great noiſes.

Wee ſee likewiſe, that great noiſes, not only offend the hearing, but euen shake houſes and towers. I haue beene told by inhabitants of Douer; that when the ArchDuke Albertus made his great battery againſt Calais (which for the time was a very furious one; for he endeauoured all he could to take the towne before it could be relieued) the very houſes were shakē, and the glaſſe windowes were shiuered, with the report of his artillery. And I haue beene told by one that was in Seuill, when the gunnepouder houſe of that towne (which was ſome two miles diſtant from the place where he liued) was blowne vp, that it made the wodden shutters of the windowes in his houſe, beate and clappe againſt the walles with greate violence, and did ſplitte the very walles of a faire church that ſtanding next it (though att a good diſtance) had no other building betweene to shelter it from the impetuoſity of the ayres ſoddaine violent motion.

And after a fight I once had with ſome galleaſſes and Galliones in the roade of Scanderone (which was a very hoat one for the time, and a ſcarce credible number of pieces of ordinance were shott from my fleete) the English Conſull of that place coming afterwardes aboard my shippe, tould me that the report of our gunnes, had, during all the time of the fight, shaken the drinking glaſſes that ſtood vpon shelues in his houſe; and had ſplitte the paper windowes all about; and had ſpoyled and cracked all the egges that his pigeons were then ſitting vpon: which loſſe, he lamented exceedingly; for they were of that kind, which commonly is called *Carriers*, and ſerue them dayly in their commerce betweene that place and Aleppo.

And I haue often obſerued att ſea, in ſmooth water, that the ordinance shott of in a shippe ſome miles diſtant, would violently shake the glaſſe windowes in an other. And I haue perceiued this effect in my owne, more then once, att the report of a ſingle gunne from a shippe ſo farre off, that we could not deſcry her. I remember how one time, vpon ſuch an

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occasion, we altered our course and steared with the sound, or rather with the motion att the first, obseruing vpon which poynt of the compasse the shaking appeared (for as yet we heard nothing; though soone after with much attention and silence we could discerne a dull clumsy noise: and such a motion groweth att the end of it so faint that if any strong resisting body checke it in its course, it is presently deaded, and will afterwardes shake nothing beyond that body: and therefore it is perceptible only att the out side of the shippe, if some light and very moueable body do hang loosely on that side it cometh, to receiue the impression of it; as this did att the gallery windowes of my cabin vpon the poope, which were of light moscouia glasse or talke:) and by then we had runne somewhat more then a watch, with all the sayles abroad we could make, and in a faire loome gale, we found our selues neere enough to part the fray of two shippes, that in a litle while longer fighting would haue sunke one an other.

4. That solide bodies may conueye the motion of the ayre or sound to the organe of hearing.

But besides the motions of the ayre (which receiueth them easily, by reason of the fluidity of it) we see that euen solide bodies do participate of it. As if you knocke neuer so lightly att one end of the longest beame you can find, it will be distinctly hard att the other end: the trampling of men and horses in a quiet might, will be heard some miles off, if one lay their eare to the ground; and more sensibly if one make a litle hole in the earth, and putt ones eare into the mouth of it; but most of all if one sett a drumme smooth vpon the ground, and lay ones eare to the vpper edge of it; for the lower membrane of the drumme, is shaked by the motion of the earth, and then multiplyeth that sound by the hollow figure of the drumme in the conueying it to the vpper membrane, vpon which your eare leaneth. Not much vnlike the tympane or drumme of the eare; which being shaked by outward motion, causeth a second motion on the inside of it correspondent to this first; and this hauing a free passage to the braine, striketh it immediately and so informeth it how thinges moue without: which is all the mystery of hearing.

5. Where the motion is interrupted there is no sound.

If any thing do breake or stoppe this motion; before it shake our eare, it is not heard. And accordingly we see that the sound of belles or artillery is heard much further if it haue the conduct of waters, then through the pure ayre: because in such bodies the great continuity of them maketh that one part can not shake alone, and vpon their superficies, there is no notable vneuenesse, nor no dense thing in the way to checke the motion (as in the ayre, hilles, buildinges, trees and such like:) so that the same shaking goeth a great way. And to confirme that this is the true reason, I haue seuerall times obserued, that standing by a riuers side, I haue heard the sound of a ring of belles, much more distinctly and lowde, then if I went some distance from the water, though neerer to the steeple from whence the sound came.

And it is not only the motion of the ayre, that maketh sound in our eares:

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eares: but any motion that hath acceſſe to them in ſuch a manner as to shake the quiuering membranous tympane within them, will repreſent vnto vs thoſe motions which are without, and ſo make ſuch a ſound there as if it were conueyed only by the ayre. Which is plainely ſeene, when a man lying a good way vnder water, shall there heare the ſame ſoundes, as are made aboue in the ayre: but in a more clumſie manner; according as the water, by being thicker, and more corpulent is more vnwieldy in its motions. And this I haue tryed often; ſtaying vnder water as long as the neceſſity of breathing would permitt me. Which sheweth that the ayre being ſmartly moued, moueth the water alſo, by meanes of its continuity with it; and that liquid element, being fluide and getting into the eare, maketh vibrations vpon the drumme of it like vnto thoſe of ayre.

6. That not only the motion of the ayre but all other motions coming to our eares make sounds.

But all this is nothing in reſpect of what I might in ſome ſort ſay, and yet ſpeake truth. Which is that I haue ſeene one, who could diſcerne ſoundes with his eyes. It is admirable, how one ſenſe will oftentimes ſupply the want of an other: whereof I haue ſeene an other ſtrange example in a different ſtraine from this; of a man that by his groſſer ſenſes had his want of ſight wonderfully made vp. He was ſo throughly blind, that his eyes could not informe him when the ſunne shined; for all the cryſtalline humour was out in both his eyes: yet his other ſenſes inſtructed him, ſo efficaciouſly in what was their office to haue done; as what he wanted in them, ſeemed to be ouerpayed in other abilities. To ſay that he would play att cardes and tables as well as moſt men; is rather a commendation of his memory and fanſye, then of any of his outward ſenſes. But that he should play well att boules and shouelbord, and other games of ayme, which in other men do require cleare ſight, and an exact leuell of the hand, according to the qualities of the earth or table, and to the ſituation and diſtance of the place he was to throw att, ſeemeth to exceede poſſibility: and yet he did all this.

7. How one ſenſe may ſupply the want of an other.

He would walke in a chamber or long alley in a garden (after he had beene a while vſed to them) as ſtraight, and turne as iuſt att the endes, as any ſeeing man could do. He would go vp and downe euery where ſo confidently, and demeane himſelfe att table ſo regularly, as ſtrangers haue ſitten by him ſeuerall meales, and haue ſeene him walke about the houſe, without euer obſeruing any want of ſeeing in him: which he endeauoured what he could to hide, hy wearing his hatt low vpon his browes. He would, att the firſt abord of a ſtranger, as ſoone as he ſpoke to him, frame a right apprehenſion of his ſtature, buſke and manner of making. And which is more, when he taught his ſchollers to declame (for he was ſchoolemaſter to my ſonnes, and liued in my houſe) or to repreſent ſome of Senecas Tragedies, or the like, he would by their voice know their geſture, and the ſituation they putt their bodies in: ſo that he would be able, as ſoone as they ſpoke, to iudge whether they ſtood or ſate, or in what poſture they were; which made them demeane themſelues as

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decently, before him whiles they ſpoke, as if he had ſeene them perfectly.

Though all this be very ſtrange, yet me thinkes his diſcerning of light is beyond it all. He would feele in his body, and chiefely in his braine (as he hath often told me) a certaine effect by which he did know when the ſunne was vp; and would diſcerne exactly a cleare from a cloudy day. This I haue knowne him frequently do without miſſing, when for triall ſake he hath beene lodged in a cloſe chamber, wherevnto the cleare light or ſunne could not arriue to giue him any notice by its actuall warmeth; nor any body could come to him, to giue him priuate warninges of the changes of the weather.

8. Of one who could diſcerne ſoũds of words with his eyes.

But this is not the relation I intended, when I mentioned one that could heare by his eyes; (if that expreſſion may be permitted me) I then reflected vpon a noble man of great quality that I knew in Spaine, the yonger brother of the Conſtable of Caſtile. But the reflection of his ſeeing of words, called into my remembrance the other that felt light: in whom I haue often remarked ſo many ſtrange paſſages, with amazement and delight; that I haue aduentured vpon the Readers patience to recorde ſome of them, conceiuing they may be of ſome vſe in our courſe of doctrine. But the ſpanish lord, was borne deafe; ſo deafe, that if a gunne were shott off cloſe by his eare, he could not heare it: and conſequently, he was dumbe; for not being able to heare the ſound of words; he could neither imitate nor vnderſtand them. The louelineſſe of his face and eſpecially the exceeding life and ſpiritefulneſſe of his eyes, and the comelineſſe of his perſon and whole compoſure of his body throughout, were pregnant ſignes of a well tempered mind within. And therefore all that knew him, lamented much the want of meanes to cultiuate it, and to imbue it with the notions which it ſeemed to be capable of in regard of its ſelfe; had it not been ſo croſſed by this vnhappy accident. Which to remedy Phyſitians and Chirurgions had long imployed their skill; but all in vaine. Att the laſt, there was a prieſt who vndertooke the teaching him to vnderſtand others when they ſpoke, and to ſpeake himſelfe that others might vnderſtand him. What att the firſt he was laught att for; made him after ſome yeares be looked vpon as if he had wrought a miracle. In a word; after ſtrange patience, conſtancy and paines; he brought the yong Lord to ſpeake as diſtinctly as any man whoſoeuer; and to vnderſtand ſo perfectly what others ſaid that he would not looſe a word in a whole dayes conuerſation.

They who haue a curioſity to ſee by what ſteppes the maſter proceeded in teaching him, may ſatisfy it by a booke which he himſelfe hath writt in Spanish vpon that ſubiect, to inſtruct others how to teach deafe and dumbe perſons to ſpeake. Which when he shall haue looked heedefully ouer; and shall haue conſidered what a great diſtance there is betweene the ſimplicity and nakedneſſe of his firſt principles; and the

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ſtrange readineſſe and vaſt extent of ſpeech reſulting in proceſſe of time out of them; he will forbeare pronuncing an impoſſibility in their pedigree, whiles he wondereth att the numerous effects reſulting in bodies out of rarity and denſity, ingeniouſly mingled together by an all knowing Architect, for the production of various qualities among mixtes, of ſtrange motions in particular bodies, and of admirable operations of life and ſenſe among vegetables and animals. All which, are ſo many ſeuerall wordes of the myſticall language, which the great maſter hath taught his otherwiſe dumbe ſchollers (the creatures) to proclayme his infinite art, wiſedome, perfections, and excellency in.

The prieſt who by his booke and art, occaſioned this diſcourſe, I am told is ſtill aliue, and in the ſeruice of the Prince of Carignan, where he continueth (with ſome that haue neede of his paines) the ſame employment as he did with the Conſtables Brother: with whom I haue often diſcourſed, whiles I wayted vpon the Prince of Wales (now our gratious Soueraigne) in Spaine. And I doubt not but his maieſty remembreth all I haue ſaid of him and much more: for his maieſty was very curious to obſerue and enquire into the vtmoſt of it. It is true, one great misbecomingneſſe he was apt to fall into, whiles he ſpoke: which was an vncertainty in the tone of his voyce; for not hearing the ſound he made when he ſpoke, he could not ſteedily gouerne the pitch of his voyce; but it would be ſometimes higher ſometimes lower; though for the moſt part, what he deliuered together, he ended in the ſame key as he begunne it. But when he had once ſuffered the paſſages of his voyce to cloſe, att the opening them againe, chance, or the meaſure of his earneſtneſſe to ſpeake or to reply, gaue him his tone: which he was not capable of moderating by ſuch an artifice, as is recorded Caius Gracchus vſed, when paſſion, in his orations to the people, droue out his voyce with too great a vehemence or ſhrilleneſſe.

He could diſcerne in an other, whether he spoke shrill or lowe: and he would repeate after any body, any hard word whatſoeuer. Which the Prince tryed often; not only in English, but by making ſome Welchmen that ſerued his Highneſſe, ſpeake wordes of their language. Which he ſo perfectly ecchoed, that I confeſſe I wondered more att that, then att all the reſt. And his Maſter himſelfe would acknowledge, that the rules of his art, reached not to produce that effect with any certainety. And therefore concluded, this in him muſt ſpring from other rules he had framed vnto himſelfe, out of his owne attentiue obſeruation: which, the aduantage that nature had iuſtly giuen him in the sharpeneſſe of his other ſenſes, to ſupply the want of this; endowed him with an ability and ſagacity to do, beyond any other man that had his hearing. He expreſſed it (ſurely) in a high meaſure, by his ſo exact imitation of the welch pronunciation: for that tongue (like the Hebrew) employeth much the gutturall letters: and the motions of that part which frameth them, can not be ſeene nor iudged by the eye, otherwiſe then by the effect they

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may happely make by consent in the other partes of the mouth, exposed to view: for the knowledge he had of what they said, sprung from his obseruing the motions they made; so that he could conuerse currently in the light, though they he talked with, whispered neuer so softly. And I haue seene him att the distance of a large chambers breadth, say wordes after one, that I standing close by the speaker could not heare a syllable of. But if he were in the darke, or if one turned his face out of his sight, he was capable of nothing one said.

9. Diuers reasons to proue sound to be nothing els but a motiō of some reall body.

But it is time that we returne to our theame, from whence my blind schoolemaster, and this deafe Prince (whose defects were ouerpayed an other way) haue carryed vs with so long a digression. Which yet will not be altogether vseless (no more then the former, of the wilde man of Liege) if we make due reflections vpon them: for when we shall consider, that odors may be tasted; that the relish of meates may be smelled; that magnitude and figure may be heard; that light may be felt; and that soundes may be seene; (all which is true in some sense) we may by this chāging the offices of the senses, and by looking into the causes thereof; come to discerne that these effects are not wrought by the interuention of ayery qualities; but by reall and materiall applications of bodies to bodies; which in different manners do make the same results within vs.

But when I suffered my penne to be steered by my fansie, that pleased it selfe, and rioted in the remembrance of these two notable persons: I was speaking, how the strong continuity of the partes of a thing that is moued, draweth on the motion, and consequently the sound, much further then where that which is moued suffereth breaches, or the rarity of it occasioneth that one part may be moued without an other; for to the proportion of the shaking, the noyse cōtinueth. As we see in trēbling belles, that humme a great while longer then others, after the clapper hath strucken them: and the very sound, seemeth to quiuer and shake in our eares, proportionable to the shaking of the bell. And in a lute as long as a string that hath been strucken, shaketh sensibly to our eye; so long; and to the same measure, the sound shaketh in our eare. Which is nothing else but an vndulation of the ayre, caused by the smart and thicke vibrations of the corde, and multiplyed in the belly of the instrument (which is the reason that the concaue figure is affected in most) and so, when it breaketh out of the instrument in greater quantity, then the string immediately did shake; it causeth, the same vndulations in the whole body of ayre round about. And that, striking the drumme of the eare, giueth notice there in what tenour the string moueth: whose vibrations if one stoppe by laying his fingar vpon it, the Sound is instantly att an end, for then there is no cause on foote, that continueth the motion of the ayre: which, without a continuation of the impulse; returneth speedily to quiett; through the resistance made vnto it, by other partes of it that are further off.

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Out of all which, it is plaine, that motion alone is able to effect, and to giue account of all thinges whatsoeuer that are attributed to sound; and that sound and motion, do goe hand in hand together; and that whatsoeuer is said of the one, is likewise true of the other. Wherefore it can not be denyed but that *hearing* is nothing else but the due perception of *motion*: and that *motion* and *sound* are in themselues one and the same thing, though expressed by different names, and compriſed in our vnderstanding vnder different notions. Which proposition seemeth to be yet further conuinced, by the ordinary experience of perceiuing musike by mediation of a sticke: for how should a deafe man be capable of musike by holding a sticke in his teeth, whose other end lyeth vpon the vyall or virginals, were it not that the proportionall shaking of the sticke (working a like dauncing in the mans head) did make a like motion in his braine, without passing through his eare? and consequently, without being otherwise *sound*, then as bare motion is *sound*.

Or if any man will still persist in hauing sound be some other thing then as we say; and that it affecteth the sense otherwise then purely by motion: he must neuertheleſſe acknowledge, that whatsoeuer it be, it hath neyther cause nor effect, nor breeding, nor dying, that we eyther know or can imagine: and then, if he will lett Reason sway, he will conclude it vnreasonable to say or suspect so ill grounded a surmise, against so cleare and solide proofes: which our eares themselues do not a litle confirme; their whole figure and nature tending to the perfect receiuing, conseruing, and multiplying the motions of ayre which happen without a man: as who is curious, may plainely see in the Anatomistes bookes and discourses.

THE NINE AND TWENTIETH CHAPTER.

Of Sight; and Colours.

THere is yet left, the obiect of our sight, *which we call colour*, to take a suruey of; for as for *light*, we haue att large displayed the nature and properties of it: from which whether colour be different or no, will be the question we shall next discusse: for those who are cunning in Optikes, will, by refractions and by reflexions make all sortes of colours out of pure light: as we see in Rainebowes, in those triangular glasses, or prismes which some do call *fooles Paradises*, and in other inuentions for this purpose. Wherefore, in briefe, to shew what colour is, lett vs lay for a ground, that light is of all other thinges in the world, the greatest and the most powerfull agent vpon our eye; eyther by it selfe, or by what cometh in with it: and that, where light is not, darkeneſſe is; then consider, that light being diuersly to be cast, but

1. That Colours are nothing but light mingled with darkneſſe; or the disposition off a bodies superficies apt to reflect light so mingled.

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especially, through or from a transparent body, into which it sinketh in part, and in part it doth not: and you will conclude, that it can not choose but come out from such a body, in diuers sortes mingled with darkenesse: which if it be in a sensible quantity, doth accordingly make diuers appearances: and those appearances must of necessity haue diuers hues, representing the colours which are middle colours betweene white and blacke; since white is the colour of light; and darkenesse seemeth blacke. Thus, those colours are ingendred, which are called apparent ones. And they appeare sometimes but in some one position; as in the raynebow; which changeth place as the looker on doth: but att other times, they may be seene from any part; as those which light maketh by a double refraction through a triangular glasse.

And that this is rightly deliuered, may be gathered out of the conditions requisite to their production: for that crystall, or water, or any refracting body, doth not admitt light in all its partes, is euident, by reason of the reflexion that it maketh, which is exceeding great: and not only from the superficies, but euen from the middle of the body within: as you may see plainely, if you putt it in a darke place, and enlighten but one part of it: for then, you may perceiue, as it were, a current of light passe quite through the body, although your eye be not opposite to the passage: so that, manifestly it reflecteth to your eye, from all the inward partes which it lighteth vpon.

Now a more oblique reflexion or refraction doth more disperse the light, and admitteth more priuations of light in its partes, then a lesse oblique one: as Galileo hath demonstrated in the first Dialogue of his systeme. Wherefore, a lesse oblique reflexion or refraction, may receiue that in quality of light, which a more oblique one maketh appeare mingled with darkenesse; and consequently, the same thing will appeare colour in one, which sheweth it selfe plaine light in the other; for the greater the inclination of an angle is, the greater also is the dispersion of the light.

And as colours are made in this sort, by the medium through which light passeth, so if we conceiue the superficies from which the light reflecteth, to be diuersly ordered in respect of reflexion; it must of necessity follow that it will haue a diuers luster and sight: as we see by experience in the neckes of pigeons, and in certaine positions of our eye, in which the light passing through our eye browes, maketh an appearance as though we saw diuers colours streaming from a candle we looke vpon. And accordingly we may obserue how some thinges, or rather most, do appeare of a colour more inclining to white, when they are irradiated with a great light, then when they stand in a lesser. And we see painters heighten their colours, and make them appeare lighter by placing deepe shadowes by them: euen so much, that they will make obiects appeare neerer and further of, meerly by their mixtion of their colours. Because, obiects, the neerer they are, the more strongly and liuely

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liuely they reflect light, and therefore, appeare the clearer, as the others do more dusky.

Therefore, if we putt the superficies of one body to haue a better disposition for the reflexion of light, then an other hath; we can not but conceiue, that such difference in the superficies, must needes begett variety of permanent colours in the bodies. And according as the superficies of the same body, is better, or worse disposed to reflexion of light, by polishing, or by compressure together, or the like: so, the same body, remaining the same in substance, will shew it selfe of a different colour. And it being euident that white (which is the chiefest colour) doth reflect most light: and as euident, that blacke reflecteth least light, so that it reflecteth shadowes in lieu of colours (as the Obsidian stone among the Romanes doth witnesse.) And it being likewise euident, that to be dense and hard, and of small partes, is the disposition of the obiect which is most apt to reflect light: we can not doubt, but that *white* is that disposition of the superficies. That is to say, it is the superficies of a body consisting of dense, of hard, and of small partes; and on the contrary side, that blacke is the disposition of the superficies, which is most soft and full of greatest pores; for when light meeteth with such a superficies, it getteth easily into it; and is there, as it were absorpt and hidden in caues, and cometh not out againe to reflect towardes our eye.

2. Cõcerning the disposition of those bodies which produce white or blacke coulours.

This doctrine of ours of the genetation of colours, agreeth exactly with Aristotles principles, and followeth euidently out of his definitions of *light*, and of colours. And for summing vp the generall sentiments of mankind in making his Logicall definitions, I thinke no body will deny his being the greatest Master that euer was. He defineth light to be *actus Diaphani*: which we may thus explicate. It is that thing, which maketh a body that hath an aptitude or capacity of being seene quite through it in euery interior part of it, to be actually seene quite through, according to that capacity of it. And he defineth colour to be, *The terme or ending of a diaphanous body*: the meaning whereof is: that colour is a thing which maketh a diaphanous body to reach no further; or that colour is the cause why a body is no further diaphanous, then vntill where it beginneth; or that colour, is the reason, why we can see no further then to such a degree, through or into such a body.

3. The former doctrine cõfirmed by Aristoteles authority, reason, and experience.

Which definition fitteth most exactly with the thing it giueth vs the nature of. For it is euident, that when we see a body, the body we see, hindereth vs from seeing any other, that is in a straight line beyond it. And therefore it can not be denyed, but that colour terminateth, and endeth the diaphaneity of a body, by making it selfe be seene. And all men do agree in conceiuing this, to be the nature of colour; and that it is a certaine disposition of a body, whereby that body cometh to be seene. On the other side, nothing is more euident, then that to haue vs see a body, light must reach from that body to our eye. Then adding vnto

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this what Aristotle teacheth concerning the production of seeing: which he sayth is made by the action of the seene body vpon our sense: it followeth that the obiect must worke vpon our sense, eyther by light; or att the least with light; for light rebounding from the obiect round about by straight lines, some part of it must needes come from the obiect to our eye. Therefore, by how much an obiect sendeth more light vnto our eye, by so much, that obiect worketh more vpon it.

Now seeing that diuers obiects do send light in diuers manners to our eye, according to the diuers natures of those obiects in regard of hardenesse, density, and litlenesse of partes: we must agree that such bodies do worke diuersely, and do make different motions or impressiõs vpon our eye: and consequẽtly, the passion of our eye from such obiects must be diuers. But there is no other diuersity of passion in the eye from the obiect in regard of seeing, but that the obiect appeare diuers to vs in point of colour. Therefore we must conclude, that diuers bodies (I meane diuers or different, in that kind we here talke of) must necessarily seeme to be of diuers colours, meerely by the sending of light vnto our eye in diuers fashions. Nay, the very same obiect must appeare of different colours, whensoeuer it happeneth that it reflecteth light differently to vs. As we see in cloth, if it be gathered together in fouldes, the bottomes of those fouldes shew to be of one kind of colour, and the toppes of them, or where the cloth is stretched out to the full percussion of light, it appeareth to be of an other much brighter colour. And accordingly painters are faine to vse almost opposite colours to expresse them. In like manner if you looke vpon two pieces of the same cloth, or plush, whose graines lye contrawise to one an other, they will likewise appeare to be of different colours. Both which accidents, and many others like vnto them in begetting various representations of colours; do all of them arise out of lightes being more or lesse reflected from one part then from an other.

4. How the diuersity of coulours doe follow out of various degrees of rarity and density.

Thus then you see, how colour is nothing else, but the disposition of a bodies superficies, as it is more or lesse apt to reflect light; sithence the reflexion of light is made from the superficies of the seene body, and the variety of its reflexion begetteth variety of colours. But a superficies is more or lesse apt to reflect light, according to the degrees of its being more or lesse penetrable by the force of light striking vpon it; for those rayes of light that gaine no entrance into a body they are darted vpon, must of necessity fly backe againe from it. But if light doth gett entrance and penetrate into the body; it eyther passeth quite through it; or else it is swallowed vp and lost in that body. The former, constituteth a diaphanous body; as we haue already determined. And the semblance which the latter will haue in regard of colour, we haue also shewed must be blacke.

But lett vs proceede a little further. We know that two thinges render a body penetrable, or easie to admitt an other body into it. Holes, (such

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as we call pores) and ſoftneſſe or humidity; ſo that dryeneſſe, hardneſſe, and compactedneſſe, muſt be the properties which render a body impenetrable. And accordingly we ſee, that if a diaphanous body (which ſuffereth light to runne through it) be much compreſſed beyond what it was; as when water is compreſſed into yce; it becometh more viſible, that is, it reflecteth more light: and conſequently, it becometh more white; for white is that, which reflecteth moſt light.

On the cõtrary ſide, ſoftneſſe, vnctuouſneſſe, and viſcouſneſſe, encreaſeth blackneſſe: as you may experience in oyling or in greaſing of wood; which before was but browne; for thereby it becometh more blacke; by reaſon that the vnctuous partes added vnto the other, do more eaſily then they ſingle, admitt into them the light that ſtriketh vpon them; and when it is gotten in, it is ſo entangled there (as though the winges of it were birdlimed ouer) that it can not fly out againe. And thus it is euident, how the origine of all colours in bodies, is plainely deduced out of the various degrees of rarity and denſity, variouſly mixed and compounded.

5. Why ſome bodies are Diaphanous others opacous.

Likewiſe, out of this diſcourſe, the reaſon is obuious why ſome bodies, are diaphanous, and others are opacous: for ſithence it falleth out in the conſtitution of bodies, that one is compoſed of greater partes then an other: it muſt needes happen that light be more hindered in paſſing through a body compoſed of bigger partes, then an other whoſe partes are leſſe. Neyther doth it import that the pores be ſuppoſed as great as the partes, for be they neuer ſo large, the corners of the thicke partes they belong vnto, muſt needes breake the courſe of what will not bowe, but goeth all in ſtraight lines; more then if the partes and pores were both leſſer; ſince, for ſo ſubtile a piercer as light, no pores can be too litle to giue it entrance. It is true ſuch great ones would better admitt a liquid body into them, ſuch a one as water or ayre; but the reaſon of that is, becauſe they will bowe and take any plye, to creepe into thoſe cauities, if they be large enough, which light will not do.

Therefore it is cleare, that freedome of paſſage can happen vnto light, only there, where there is an extreme great multitude of pores and partes in a very litle quantity or bulke of body (which pores and partes muſt conſequently be extreme litle ones) for, by reaſon of their multitude, there muſt be great variety in their ſituation: from whence it will happen that many lines muſt be all of pores quite through; and many others all of partes; although the moſt, will be mixed of both pores and partes. And ſo we ſee that although the light do paſſe quite through in many places, yet it reflecteth from more, not only in the ſuperficies, but in the very body it ſelfe of the diaphanous ſubſtance. But in an other ſubſtãce of great partes, and pores there can be but few whole lines of pores, by which the light may paſſe from the obiect to make it be ſeene; and conſequently it muſt be opacous; which is the contrary of Diaphanous that admitteth many rayes of light, to paſſe through it

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from the obiect to the eye, whereby it is ſeene, though the Diaphanous hard body, do interuene betweene them.

6. The former doctrine of coulours cõfirmed by the generation of white and Blacke in bodies.

Now if we conſider the generation of theſe two colours (white and blacke) in bodies; we ſhall find that likewiſe to iuſtify and ſecond our doctrine: for white thinges are generally cold and dry; and therefore, are by nature ordained to be receptacles, and conſeruers of heat, and of moyſture; as Phyſitians do note. Contrariwiſe, blacke, as alſo greene, (which is neere of kinne to blacke) are growing colours, and are the dye of heate incorporated in aboundance of wett: as we ſee in ſmoake, in pittecoale, in garden ground, and in chymicall putrefactions: all which are blacke; as alſo in yong herbes; which are generally greene as long as they are yong and growing. The other colours, keeping their ſtanding betwixt theſe, are generated by the mixture of them; and according as they partake more or leſſe of eyther of them, are neerer or further off from it.

So that after all this diſcourſe, we may conclude in short; that the colour of a body, is nothing elſe, but the power which that body hath of reflecting light vnto the eye, in a certaine order and poſition: and conſequently, is nothing elſe but the very ſuperficies of it, with its aſperity, or ſmoothneſſe; with its pores, or inequalities; with its hardeneſſe, or ſoftneſſe; and ſuch like. The rules and limits whereof, if they were duely obſerued and ordered, the whole nature and ſcience of colours, would eaſily be knowne and be deſcribed. But out of this litle which we haue deliuered of this ſubiect, it may be rightly inferred that reall colours do proceed from Rarity and Denſity (as euen now we touched) and haue their head and ſpring there: and are not ſtrange qualities in the ayre: but are tractable bodies on the earth, as all others are, which as yet we haue found and haue meddled with all: and are indeed, the very bodies themſelues, cauſing ſuch effects vpon our eye by reflecting of light, which we expreſſe by the names of colours.

THE THIRTIETH CHAPTER.

Of luminous or apparente Colours.

1. Apparitions of coulours through a priſme or triãgular glaſſe are of two ſortes.

AS for the luminous colours, whoſe natures art hath made more maniable by vs, then thoſe which are called reall colours, and are permanent in bodies: their generation is cleerely to be ſeene in the Priſme or triangular glaſſe we formely mentioned. The conſidering of which, will confirme our doctrine, that euen the colours of bodies, are but various mixtures of light and shadowes, diuerſly reflected to our eyes. For the right vnderſtanding of them, we are to note, that this glaſſe maketh apparitions of colours in two ſorts: the one, when looking through it, there

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there appeare various colours in the obiects you looke vpon (different from their reall ones) according to the position you hold the glasse in when you looke vpon them. The other sort is, when the beames of light that passe through the glasse, are as it were tincted in their passage, and are cast by the glasse vpon some solide obiect, and do appeare there in such and such colours, which do continue still the same, in what position soeuer you stand to looke vpon them; eyther before, or behind, or on any side of the glasse.

2. The seuerall parts of the obiect make seuerall angles at their entrance into the prisme.

Secondly, we are to note that these colours are generally made by refraction (though sometimes it may happen otherwise, as aboue we haue mentioned.) To discouer the reason of the first sort of colours, that appeare by refraction when one looketh through the glasse: lett vs suppose two seuerall bodies, the one blacke, the other white, lying close by one an other, and in the same horizontall parallele; but so, that the blacke be further from vs then the white; then, if we hold the Prisme through which we are to see these two oppositely coloured bodies somewhat aboue them; and that side of it att which the coloured bodies must enter into the glasse to come to our eye, parallele vnto those bodies; it is euident, that the blacke will come into the prisme by lesser angles thē the white: I meane that in the line of distance from that face of the glasse att which the colours do come in, a lōger line or part of blacke will subtend an angle, no bigger then a lesser line or part of white doth subtend.

3. The reason why some times the same obiect appeareth throwgh the prisme in two places: and in one place more liuely, in the other place more dimmes.

Thirdly, we are to note, that from the same poynt of the obiect, there come various beames of light to that whole superficies of the glasse; so that it may, and sometimes doth happen, that from the same part of the obiect, beames may be reflected to the eye, from seuerall partes of that superficies of the glasse att which they enter. And whensoeuer this happeneth, the obiect must necessarily be seene in diuers partes: that is, the picture of it will att the same time appeare to the eye in diuers places. And particularly, we may plainely obserue two pictures, one a liuely and strong one; the other a faint and dimme one. Of which the dimme one will appeare neerer vs, then the liuely one: and is caused by a secondary ray: or rather I should say, by a longer ray, that striking neerer to the hither edge of the glasses superficies (which is the furtheſt from the obiect) maketh a more acute angle then a shorter ray doth, that striketh vpon a part of the glasse further from our eye, but neerer the obiect. And therefore the image which is made by this secondary or longer ray, must appeare both neerer and more dusky, then the image made by the primary and shorter ray. And the further from the obiect that the glasse through which it reflecteth is situated (keeping still in the same parallele to the horizon) the further the place where the second dusky picture appeareth, is from the place where the primary strong picture appeareth.

If any man haue a mind to satisfy himselfe by experience, of the truth of this note, lett him place a sheete of white paper vpon a blacke carpett

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couering a table, so as the paper may reach within two or three fingers of the edge of the carpet, (vnder which, lett there be nothing to succeed the blacke of the carpet, but the empty dusky ayre) and then lett him sett himselfe at a conuenient distance, (the measure of which is, that the paper appeare at his feete, when he looketh through the glasse) and looke at the paper through his Prisme situated in such sort as we haue aboue determined, and he will perceiue a whitish or lightsome shadow proceed from the liuely picture that he seeth of white, and shoote out neerer towardes him then that liuely picture is, and he will discerne that it cometh into the glasse through a part of it neerer to his eye or face, and further from the obiect then the strong image of the white doth. And further, if he causeth the neerer part of the paper to be couered with some thinne body of a sadder colour, this dimme white vanisheth: which it doth not if the further part of the paper be couered. Whereby it is euident, that it is a secondary image, proceeding from the hither part of the paper.

4. The reason of the various colours that appeare in looking throwgh a prisme.

Now then to make vse of what we haue said, to the finding out of the reason why the red and blew and other colours appeare when one looketh through a prisme: lett vs proceede vpon our former example, in which a white paper lyeth vpon a blacke carpett (for, the diametrall opposition of those colours, maketh them most remarkable) in such sort that there be a parcell of blacke on the hither side of the paper: and therein, lett vs examine according to our groundes, what colours must appeare at both endes of the paper looking vpon them through the triangular glasse.

To beginne with the furtheſt end, where the blacke lyeth beyond the white: we may consider, how there must come from the blacke, a secondary darke mysty shadow (besides the strong blacke that appeareth beyond the paper) which must shoote towardes you (in such sort as we said of the whitish lightsome shadow) and consequently, must lye ouer the strong picture of the white paper: now in this case, a third middling colour must result out of the mixture of these two extremes of blacke and white; since they come to the eye, almost in the same line, at the least in lines that make so litle a difference in their angles as it is not discernable.

The like whereof happeneth in clothes, or stuffes, or stockings, that are wouen of diuers coloured but very small thriddes: for if you stand so farre of from such a piece of stuffe, that the litle thriddes of different colours which lye immediate to one an other may come together as in one line to your eye; it will appeare of a middling colour, different from both those that it resulteth from: but if you stand so neere that each thridde sendeth rays enough to your eye, and that the basis of the triãgle which cometh from each thridde to your eye, be long enough to make at the vertex of it (which is in your eye) an angle bigg enough to be seene singly by it selfe; then each colour will appeare apart as it truly is.

Now the

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Now the various natures of middling colours we may learne of painters; who compoſe them vpon their palettes by a like mixture of the extremes. And they tell vs, that if a white colour preuaile ſtrongly ouer a darke colour, reds and yellowes reſult out of that mixture: but if blacke preuaile ſtrongly ouer white, then, blewes, violets, and ſeagreenes are made. And accordingly, in our caſe, we can not doubt but that the primary liuely picture of the white, muſt preuaile ouer the faint dusky ſable mantle with which it cometh mingled to the eye: and doing ſo, it muſt needes make a like appearance as the ſunnes beames do, when reflecting from a blacke cloud, they fringe the edges of it with red and with yellow; and the like he doth, when he looketh through a rainy or a windy cloude: and much like herevnto, we shall ſee this mixture of ſtrong white with a faint shaddow of blacke, make at this brimme of the paper, a faire ledge of red; which will end and vanish, in a more light-ſome one of yellow.

But at the hither edge of the paper, where the ſecondary weake picture of white is mingled with the ſtrong blacke picture, in this mixture, the blacke is preualent, and accordingly (as we ſaid of the mixture of the painters colours) there muſt appeare at the bottome of the paper, a lembe of deepe blew: which will grow more and more light-ſome, the higher it goeth: and ſo, paſſing through violet and ſeagreene it will vanish in light, when it reacheth to the maſtering field of primary whiteneſſe, that ſendeth his ſtronger rayes by direct lines: and this tranſpoſition of the colours at the ſeuerall endes of the paper sheweth the reaſon why they appeare quite contrary, if you put a blacke paper vpon a white carpet. And therefore, we neede not adde any thing particularly concerning that.

5. The reaſō why the priſme in one poſition, may make the colours appeare quite contrary to what they did, when it was in an other poſition.

And likewiſe, out of this we may vnderſtand, why the colours appeare quite contrary (that is, red where before blew appeared; and blew, where red) if we looke vpon the ſame obiect through the glaſſe in an other poſition or ſituation of it: namely, if we rayſe it ſo high, that we muſt looke vpwardes to ſee the obiect; which thereby appeareth aboue vs: whereas in the former ſituation, it came in through the lower ſuper-ficies, and we looked downe to it, and it appeared vnder vs: for in this ſecond caſe, the obiects coming into the glaſſe by a ſuperficies not parallele as before, but ſloaping, from the obiectwardes: it followeth, that the neerer the obiect is, the leſſer muſt the angle be, which it maketh with the ſuperficies; contrary to what happened in the former caſe: and likewiſe, that if from one poynt of the neerer obiect, there fall two rayes vpon the glaſſe, the ray that falleth vppermoſt, will make a leſſer angle, then the other that falleth lower: and ſo, by our former diſcourſe, that poynt may come to appeare in the ſame place with a poynt of the further obiect; and thereby make a middling colour.

So that in this caſe, the white which is neerer, will mingle his feeble picture with the blacke that is further off: whereas before the blacke that

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was further off, mingled his feeble shadow with the strong picture of the neerer white. Wherefore by our rule we borrowed of the painters, there will now appeare a blew on the further end off the paper, where before appeared a red; and by consequence on the neerer end a red will now appeare, where in the former case a blew appeared. This case we haue chosen, as the plainest to shew the nature of such colours: out of which he that is curious, may deriue his knowledge to other cases, which we omit; because our intent is only to giue a generall doctrine, and not the particulars of the science: and rather to take away admiration, then to instruct the Reader in this matter.

6. The reason of the various colours in generall by pure light passing through a prisme.

As for the various colours, which are made by strayning light through a glasse, or through some other diaphanous body; to discouer the causes and variety of them, we must examine what thinges they are that do concurre to the making of them: and what accidents may arriue vnto those thinges, to vary their product. It is cleare, that nothing interueneth or concurreth to the producing of any of these colours, besides the light it selfe which is dyed into colour, and the glasse or diaphanous body through which it passeth. In them therefore, and in nothing else, we are to make our enquiry.

To beginne then, we may obserue, that light passing through a Prisme, and being cast vpon a reflecting obiect, is not alwayes colour; but in some circumstances it still continueth light, and in others it becometh colour. Withall we may obserue that those beames which continue light, and endure very litle mutation by their passage, making as many refractions, do make much greater deflexions from the straight lines by which they came into the glasse, then those rayes do which turne to colour; as you may experience, if you oppose one surface of the glasse perpendicularly to a candle, and sett a paper (not irradiated by the candle) opposite to one of the other sides of the glasse: for vpon the paper, you shall see faire light shine without any colour: and you may perceiue, that the line by which the light cometh to the paper, is almost perpendicular to that line by which the light cometh to the prisme. But when light becometh colour, it stricketh very obliquely vpon one side of the glasse; and cometh likewise, very obliquely out of the other, that sendeth it in colour vpon a reflectent body; so that in conclusion, there is nothing left vs wherevpon to ground the generation of such colours, besides the litleness of the angle and the sloapingness of the line, by which the illuminant striketh one side of the glasse, and cometh out at the other, whem colours proceed from such a percussion.

To this then we must wholy apply our selues: and knowing that generally, when light falleth vpon a body with so great a sloaping or inclination, so much of it as getteth through, must needes be weake and much diffused; it followeth that the reason of such colours, must necessaryly consist in this diffusion and weakeness of light; which the more it is diffused, the weaker it groweth; and the more lines of darkeness,

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darkeneſſe, are betweene the lines of light, and do mingle themſelues with them.

To confirme this, you may obſerue, how iuſt at the egreſſe from the priſme of that light which going on a litle further becometh colours, no colour at all appeareth vpon a paper oppoſed cloſe to the ſide of the glaſſe; vntill remouing it further off, the colours beginne to shew themſelues vpon the edges: thereby conuincing manifeſtly, that it was the exceſſe of light which hindered them from appearing at the firſt. And in like manner, if you putt a burning glaſſe betweene the light and the priſme, ſo as to multiply the light which goeth through the priſme to the paper, you deſtroy much of the colour by conuerting it into light. But on the other ſide, if you thicken the ayre, and make it dusky with ſmoake, or with duſt; you will plainely ſee, that where the light cometh through a conuexe glaſſe (perpendicularly oppoſed to the illuminant) there will appeare colours on the edges of the cones that the light maketh: and peraduenture the whole cones would appeare coloured if the darkening were conueniently made: for if an opacous body, be ſett within eyther of the cones, its ſides will appeare coloured, though the ayre be but moderately thickned: which sheweth that the addition of a litle darkeneſſe, would make that which otherwiſe appeareth pure light, be throughly dyed into colours. And thus you haue the true and adequate cauſe of the appearance of ſuch colours.

7. Vpon what ſide euery colour appeareth that is made by pure light paſſing through a priſme.

Now, to vnderſtand what colours, and vpon which ſides, will appeare: we may conſider, that when light paſſeth through a glaſſe, or other diaphanous body, ſo much of it as shineth in the ayre, or vpon ſome reflecting body bigger then itſelf, after its paſſage through the glaſſe, muſt of neceſſity haue darkeneſſe on both ſides of it; and ſo be cõpriſed and limited by two darkeneſſes: but if ſome opacous body, that is leſſe then the light, be putt in the way of the light, then it may happen contrary wiſe, that there be darkeneſſe (or the shadow of that opacous body) betweene two lights.

Againe, we muſt conſider, that when light falleth ſo vpon a priſme as to make colours, the two outward rayes which proceed from the light to the two ſides of the ſuperficies at which the light entereth, are ſo refracted that at their coming out againe through the other ſuperficies, that ray which made the leſſe angle with the outward ſuperficies of the glaſſe, going in, maketh the greater angle with the outſide of the other ſuperficies, coming out: and contrary wiſe, that ray which made the greater angle, going in, maketh the leſſer, at its coming out: and the two internall angles, made by thoſe two rayes, and the outſide of the ſuperficies they iſſue at, are greater then two right angles: and ſo we ſee that the light dilateth it ſelfe at its coming out.

Now, becauſe rayes that iſſue through a ſuperficies, the neerer they are to be perpendiculars vnto that ſuperficies, ſo much the thicker they are: it followeth, that this dilatation of light at its coming out of the

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glaſſe, muſt be made and muſt encreaſe frō that ſide where the angle was leaſt at the going in, and greateſt at the coming out: ſo that, the neerer to the contrary ſide you take a part of light, the thinner the light muſt be there: and contrariwiſe, the thicker it muſt be, the neerer it is vnto the ſide where the angle at the rayes coming out is the greater. Wherefore, the ſtrongeſt light, (that is, the place where the light is leaſt mixed with darkeneſſe) muſt be neerer that ſide then the other. Conſequently herevnto, if by an opacous body you make a shadow comprehended within this light, that shadow muſt alſo haue its ſtrongeſt part, neerer vnto one of the lights betwixt which it is compriſed, then vnto the other: for, shadow being nothing elſe, but the want of light, hindered by ſome opacous body; it muſt of neceſſity lye auerſed from the illuminant, iuſt as the light would haue layen if it had not beene hindered. Wherefore, ſeeing that the ſtronger ſide of light, doth more impeach the darkeneſſe, then the feebler ſide doth; the deepeſt darke muſt incline to that ſide, where the light is weakeſt; that is, towardes that ſide on which the shadow appeareth, in reſpect of the opacous body or of the illuminant, and ſo, be a cauſe of deepeneſſe of colour on that ſide, if it happen to be fringed with colour.

THE ONE AND THIRTIETH CHAPTER.

The cauſes of certaine appearances in luminous Colours; with a concluſion of the diſcourſe touching the ſenſes and the ſenſible qualities.

1. The reaſon of each ſeuerall colour in particular cauſed by light paſſing through a priſme.

VPon of theſe groundes, we are to ſeeke the reſolution of all ſuch ſymptomes as appeare vnto vs in this kind of colours. Firſt therefore calling to mind, how we haue already declared, that the red colour is made by a greater proportion of light mingled with darkeneſſe, and the blew with a leſſe proportion: it muſt follow, that when light paſſeth through a glaſſe in ſuch ſort as to make colours; the mixture of the light and darkeneſſe on that ſide where the light is ſtrongeſt will incline to a red: and their mixture on the other ſide, where the light is weakeſt, will make a violet or blew: and this we ſee to fall out accordingly, in the light which is tincted by going through a priſme; for a red colour appeareth on that ſide from which the light doth dilate or decreaſe, and a blew is on that ſide towardes which it decreaſeth.

Now, if a darke body be placed within this light, ſo as to haue the light come on both ſides of it: we ſhall ſee the contrary happen about the borders of the picture or shadow of the darke body: that is to ſay, the red colour will be on that ſide of the picture which is towardes or ouer againſt the blew colour that is made by the glaſſe: and the blew of

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the picture, will be on that ſide which is towardes the red that is made by the glaſſe, as you may experience if you place a ſlender opacous body along the priſme in the way of the light, eyther before or behind the priſme. The reaſon whereof is; that the opacous body ſtanding in the middle, enuironned by light, diuideth the light, and maketh two lights of that which was but one; each of which lights, is compriſed betweene two darkeneſſes, to witt, betweene each border of ſhadow that ioyneth to each extreme of the light that cometh from the glaſſe, and each ſide of the opacous bodies ſhadow. Wherefore, in each of theſe lights; or rather in each of their commixtions with darkeneſſe, there muſt be red on the one ſide, and blew on the other, according to the courſe of light which we haue explicated.

And thus it falleth out agreable to the rule we haue giuen, that blew cometh to be on that ſide of the opacous bodies ſhadow, on which the glaſſe caſteth red, and red on that ſide of it on which the glaſſe caſteth blew: likewiſe when light going through a conuexe glaſſe maketh two cones, the edges of the cone betwixt the glaſſe and the point of concurſe will appeare red, if the roome be darke enough: and the edges of the further cone, will appeare blew, both for the reaſon giuen: for in this caſe the point of concurſe is the ſtrong light betwixt the two cones: of which, that betwixt the glaſſe and the point, is the ſtronger, that beyond the point, the weaker: and for this very reaſon, if an opacous body be put in the axis of theſe two cones, both the ſides of its picture will be red, if it be held in the firſt cone which is next to the glaſſe; and both will be blew if the body be ſituated in the further cone; for both ſides being equally ſituated to the courſe of the light, within its owne cone, there is nothing to vary the colours, but only the ſtrength and the weakeneſſe of the two lights of the cones, on this ſide, and on that ſide the point of concurſe: which point, being in this caſe the ſtrong and cleare light whereof we made generall mention in our precedent note, the cone towardes the glaſſe and the illuminant, is the ſtronger ſide, and the cone from the glaſſe, is the weaker.

In thoſe caſes, where this reaſon is not concerned, we ſhall ſee the victory carried in the queſtion of colours, by the shady ſide of the opacous body: that is, the blew colour will ſtill appeare, on that ſide of the opacous bodies ſhadow that is fartheſt from the illuminant. But where both cauſes do concurre and contraſt for precedence, there the courſe of the light carryeth it: that is to ſay, the red will be on that ſide of the opacous bodies ſhadow, where it is thicker and darker, and blew on the other ſide where the ſhadow is not ſo ſtrong; although the shadow be caſt that way that the red appeareth: as is to be ſeene, when a ſlender body is placed betwixt the priſme and the reflectent body, vpon which the light and colours are caſt through the priſme: and it is euident, that this cauſe of the courſe of the ſhadow is in it ſelfe a weaker cauſe, then the other of the courſe of light, and muſt giue way vnto it whenſoeuer

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they encounter (as it can not be expected, but that in all circumstances, shadowes should to light) becauſe the colours which the glaſſe caſteth in this caſe, are much more faint and dusky then in the other.

For effects of this later cauſe, we ſee that when an opacous body lyeth croſſe the priſme, whiles it ſtandeth endwayes, the red or blew colour, will appeare on the vpper or lower ſide of its picture, according as the illuminant is higher or lower thē the tranſuerſe opacous body: the blew euer keeping to that ſide of the picture, that is furtheſt from the body, and the illuminant that make it: and the red the contrary; likewiſe if an opacous body be placed out of the axis, in eyther of the cones we haue explicated before, the blew will appeare on that ſide of the picture which is furtheſt aduanced in the way that the shadow is caſt: and the red, on the contrary: and ſo, if the opacous body be placed in the firſt cone (beſide the axis) the red will appeare on that ſide of the picture in the baſis of the ſecond cone, which is next to the circumference; and the blew, on that ſide which is next the axis: but if it be placed on one ſide of the axis in the ſecond cone, then the blew will appeare on that ſide the picture which is next the circumference; and the red, on that ſide which is next the center of the baſis of the cone.

2. A difficult probleme reſolued touching the priſme.

There remayneth yet one difficulty of moment to be determined: which is why, when through a glaſſe, two colours (namely blew and red) are caſt from a candle vpon a paper or wall, if you put your eye in the place of one of the colours that shineth vpon the wall, and ſo that colour cometh to shine vpon your eye, in ſuch ſort that an other man who looketh vpon it, will ſee that colour plainely vpon your eye, neuertheleſſe, you shall ſee the other colour in the glaſſe? As for example, if on your eye there shineth a red, you shall ſee a blew in the glaſſe; and if a blew shineth vpon your eye, you shall ſee a red.

The reaſon hereof is, that the colours which appeare in the glaſſe, are of the nature of thoſe luminous colours which we firſt explicated, that ariſe from looking vpon white and blacke bordering together: for a candle ſtanding in the ayre, is as it were a white ſituated betweene two blackes: the circumſtant dusky ayre, hauing the nature of a blacke: ſo then, that ſide of the candle which is ſeene through the thicker part of the glaſſe, appeareth red; and that which is ſeene through the thinner, appeareth blew: in the ſame manner as when we looke through the glaſſe; whereas, the colours shine cōtrary wiſe vpon a paper or reflecting obiect, as we haue already declared, together with the reaſons of both theſe appearances; each fitted to its proper caſe, of looking through the glaſſe vpon the luminous obiect ſerrownded with darkeneſſe, in the one; and of obſeruing the effect wrought by the ſame luminous obiect in ſome medium or vpon ſome reflectent ſuperficies, in the other.

And to confirme this, if a white paper be ſett ſtanding hollow before the glaſſe (like halfe a hollow pillar, whoſe flatt ſtandeth edgewayes towardes the glaſſe, ſo as both the edges may be ſeene through it) the further

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further edge will seeme blew and the neerer will be red; and the like will happen, if the paper be held in the free ayre parallele to the lower superficies of the glasse, without any blacke carpet to limit both endes of it (which serueth to make the colours the smarter) so that in both cases, the ayre serueth manifestly for a blacke; in the first, betweene the two white edges; and in the second, limiting the two white endes: and by consequence, the ayre about the candle must likewise serue for two blackes, including the light candle betweene them.

Seuerall other delightfull experiments of luminous colours I might produce, to confirme the groundes I haue layed, for the nature and making of them. But I conceiue that these I haue mentioned, are aboundantly enough for the end I propose vnto my selfe: therefore I will take my leaue of this supple and nice subiect; referring my Reader (if he be curious to entertaine himselfe with a full variety of such shining wonders) to our ingenious countryman and my worthy frend, Mr. Hall: who at my last being at Liege, shewed me there most of the experiences I haue mentioned; together with seuerall other very fine and remarkable curiosities concerning light; which he promised me he would shortly publish in a worke, that he had already cast and almost finished vpon that subiect: and in it, I doubt not but he will giue entire satisfaction to all the doubts and Problemes that may occurre in this subiect: whereas my litle exercise formerly, in making experiments of this kind, and my lesse conueniency of attempting any now, maketh me content my selfe with thus spinning of a course thridde frō wooll carded me by others, that may runne through the whole doctrine of colours, whose causes haue hitherto beene so much admired: and that it will do so, I am strōgly persuaded, both because if I looke vpō the causes which I haue assigned *a priori*, me thinkes they appeare very agreeable to nature and to reason; and if I apply them to the seuerall Phoenomēs which Mr. Hall shewed me, and to as many others, as I haue otherwise mett with, I find they agree exactly with them, and render a full account of them.

And thus, you haue the whole nature of luminous colours, resolued into the mixtion of light and darkenesse: by the due ordering of which, who hath skill therein, may produce any middle colour he pleaseth: as I my selfe haue seene the experience of infinite changes in such sort made; so that it seemeth vnto me, nothing can be more manifest, then that luminous colours are generated in the way that is here deliuered. Of which how that gentle and obedient Philosophy of *Qualities* (readily obedient to what hard taske soeuer you assigne it) will render a rationall account; and what discreet vertue, it will giue the same thinges to produce different colours, and to make different appearances, meerely by such nice changes of situation, I do not well vnderstand: but peraduenture the Patrones of it, may say that euery such circumstance is a *Conditio sine qua non*: and therewith (no doubt) their Auditors will be much the wiser in comprehending the particular nature of light,

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and of the colours that haue their origine from it.

3. Of the raine-bow, and how by the colour of any body wee may know the compoſitiō of the body it ſelfe.

The Rainebow, for whoſe ſake moſt men handle this matter of luminous colours, is generated in the firſt of the two wayes we haue deliuered for the production of ſuch colours: and hath its origine from refraction, when the eye being at a conuenient diſtance from the refracting body, looketh vpon it to diſcerne what appeareth in it. The ſpeculation of which may be found in that excellent diſcourſe of Monſieur des Cartes, which is the ſixt of his Meteors; where he hath with great acurateneſſe deliuered a moſt ingenious doctrine of this myſtery: had not his bad chance of miſſing in a former principle (as I conceiue) ſomewhat obſcured it. For he there giueth the cauſe ſo neate, and ſo iuſtly calculated to the appearances, as no man can doubt but that he hath found out the true reaſon of this wonder of nature, which hath perplexed ſo many great witts: as may almoſt be ſeene with our very eyes; when looking vpon the fresh deaw in a ſunneshiny morning, we may in due poſitions perceiue the raynebow colours, not three yardes diſtant from vs: in which we may diſtinguish euen ſingle droppes with their effects. But he hauing determined the nature of light to conſiſt in motion, and proceeding conſequently, he concludeth colours to be but certaine kindes of motion: by which I feare it is impoſſible that any good account should be giuen of the experiences we ſee.

But what we haue already ſaid in that point, I conceiue is ſufficient to giue the reader ſatisfaction therein: and to ſecure him, that the generation of the colours in the rainebow, as well as all other coulours, is likewiſe reduced to the mingling of light and darkeneſſe: which is our principall intent to proue: adding therevnto by way of aduertiſſement, for others whoſe leiſure may permitt them to make vſe thereof, that who ſhall ballance the proportions of luminous colours, may peraduenture make himſelfe a ſteppe to iudge of the natures of thoſe bodies, which really and conſtantly do weare like dyes; for, the figures of the leaſt partes of ſuch bodies, ioyntly with the connexion or mingling of them with pores, muſt of neceſſity be that which maketh them reflect light vnto our eyes, in ſuch proportions, as the luminous colours of their tincture and ſemblance do.

For two thinges are to be conſidered in bodies, in order to reflecting of light: eyther the extancies and cauities of them; or their hardeneſſe and ſofteneſſe. As for the firſt; the proportions of light mingled with darkeneſſe will be varied, according as the extancies or the cauities do exceed, and as each of them is great or ſmall: ſince cauities haue the nature of darkeneſſe, in reſpect of extancies, as our moderne Aſtronomers do shew, when they giue account of the face (as ſome call it) in the orbe of the moone. Likewiſe in regard of ſoft or of reſiſtent partes, light will be reflected by them, more or leſſe ſtrongly, that is, more or leſſe mingled with darkeneſſe; for whereas it reboundeth ſmartly backe, if it ſtriketh vpon a hard and a reſiſtent body, and accordingly

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will shew it selfe in a bright colour: it must of necessity not reflect at all, or but very feebly, if it penetrateth into a body of much humidity, or if it looseth it selfe in the pores of it; and that litle which cometh so weakely from it, must consequently appeare of a dusky dye: and these two, being all the causes of the great variety of colours we see in bodies, according to the quality of the body, in which the reall colour appeareth, it may easily be determined from which of them it proceedeth: and then, by the colour, you may iudge of the composition and mixture of the rare and dense partes, which by reflecting light begetteth it.

4. That all the sēsible qualities are reall bodies resulting out of seuerall mixtures of rarity and density.

In fine, out of all we haue hitherto saïd in this Chapter, we may conclude the primary intent of our so long discourse; which is, that as well the senses of liuing creatures, as the sensible qualities in bodies, are made by the mixtion of rarity and density, as well as the naturall qualities we spoke of in their place: for it can not be denyed but that heate and cold, and the other couples or payres, which beate vpon our touch, are the very same as we see in other bodies: the qualities which moue our tast and smell, are manifestly a kinne and ioyned with them: light we haue concluded to be fire: and of motion (which affecteth our eare) it is not disputable: so that it is euident, how all sensible qualities, are as truly bodies, as those other qualities which we call naturall.

To this we may adde, that the proprieties of these sensible qualities, are such as proceed euidently from rarity and density; for (to omitt those which our touch taketh notice of, as too plaine to be questioned) Physitians iudge and determine the naturall qualities of meates, and of medecines, and of simples, by their tastes and smels: by those qualities they find out powers in them to doe materiall operatiōs; and such as our instrumēts for cutting, filing, brushing, and the like, doe vnto ruder and grosser bodies. All which vertues, being in these instruments by the different tempers of rarity and density, is a conuincing argument, that it must be the same causes, which must produce effects of the same kind in their smels and tastes: and as for light, it is knowne how corporeally it worketh vpon our eyes.

Againe, if we looke particularly into the composition of the organes of our senses; we shall meet with nothing but such qualities as we find in the composition of all other naturall bodies. If we search into our eye, we shall discouer in it nothing but diaphaneity, softenesse, diuers colours, and consistencies; which all Anatomistes, to explicate, doe parallele in other bodies: the like is of our tongue, our nosethrilles, and our eares. As for our touch; that is so materiall a sense, and so diffused ouer the whole body, we can haue no difficulty about it. Seeing then that all the qualities we can discouer in the organes of our senses, are made by the various minglings of rarity with density, how can we doubt, but that the actiue powers ouer these patients, must be of the same nature and kind.

Againe, seing that the examples aboue brought, doe conuince, that the obiects of one sense, may be knowne by an other; who can doubt of a

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community among them, if not of degree, at the leaſt of the whole kind? As we ſee that the touch, is the groundworke of all the reſt; and conſequently, that being euidently corporeall, and conſiſting in a temper of rarity and denſity, why should we make difficulty in allowing the like of the reſt?

Beſides, lett vs compoſe of rarity and denſity, ſuch tempers as we find in our sēſes; and lett vs againe compoſe of rarity and denſity, ſuch actors, as we haue determined the qualities, which we call ſenſible, to be; and will it not manifeſtly follow, that theſe two applyed to one an other, muſt produce ſuch effects, as we affirme our ſenſes haue? that is, to paſſe the outward obiects, by different degrees, vnto an inward receiuer.

5. Why the ſenſes are only fiue in number: with a concluſion of all the former doctrine concerning them.

Againe, lett vs caſt our eyes vpon the naturall reſolution of bodies, and how they moue vs, and we shall thereby diſcouer, both what the ſenſes are, and why they are iuſt ſo many, and that they can not be more. For an outward body may moue vs, eyther in its owne bulke or quantity; or as it worketh vpon an other. The firſt is done by the touch: the ſecond by the eare, when a body mouing the ayre, maketh vs take notice of his motion. Now in reſolution, there are three actiue partes proceeding from a body, which haue power to moue vs. The fiery part; which you ſee worketh vpon our eyes, by the vertue of light. The ayry part; which we know moueth our noſethrilles, by being ſucked in with the ayre. And laſtly the ſalt; which diſſolueth in water, and ſo moueth our watry ſenſe; which is our taſte.

And theſe being all the actiue partes, that shew themſelues in the reſolution of a body; how can we imagine there should be any more ſenſes to be wrought vpon? for what the ſtable body sheweth of it ſelfe, will be reduced to the touch: what as it moueth, to hearing: what the reſolutions of it, according to the nature of the reſolued atomes that fly abroade; will concerne the other three ſenſes, as we haue declared. And more wayes of working, or of actiue partes, we can not conceiue to ſpring out of the nature of a body.

Finally, if we caſt our eyes vpon the intention of nature: to what purpoſe are our ſenſes, but to bring vs into knowledge of the natures of the ſubſtances we conuerſe with all? ſurely, to effect this, there can not be inuented a better, or more reaſonable expedient, then to bring vnto our iudgement ſeate the likeneſſes or extractes of thoſe ſubſtances, in ſo delicate a modell, that they may not be offenſiue or cumberſome; like ſo many patternes preſented vnto vs, to know by them, what the whole piece is. for all ſimilitude, is a communication betweene two thinges in that quality, wherein there likeneſſe conſiſteth: and therefore we can not doubt, but that nature hath giuen vs, by the meanes we haue explicated, an eſſay of all the thinges in the world, that fall vnder our commerce, whereby to iudge whether they be profitable or nociue vnto vs; and yet in ſo delicate and ſubtile a quantity, as may in no wayes be offenſiue to vs, whiles we take our meaſures to attract what is good, and auoyde what is noxious.

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THE TWO AND THIRTIETH CHAPTER.

Of ſenſation, or the motion whereby ſenſe is properly exerciſed.

1. Monſieur des Cartes his opinion touching ſenſation.

VT of the conſiderations which we haue deliuered in theſe laſt Chapters, the Reader may gather the vnreaſonableneſſe of vulgar Phyloſophers, who to explicate life and ſenſe, are not content to giue vs termes without explicating them; but will force vs to beleeue contradictions: telling vs, that life conſiſteth in this, that the ſame thing hath a power to worke vpon it ſelfe: and that ſenſation, is a working of the actiue part of the ſame ſenſe, vpon its paſſiue part; and yet will admitt no partes in it: but will haue the ſame indiuiſible power worke vpon it ſelfe. And this, with ſuch violence and downebearing of all oppoſition, that they deeme him not conſiderable in the ſchooles, who ſhall offer only to doubt of what they teach him hereabout; but brand him with the cenſure of one who knoweth not, and contradicteth the very firſt principles of Phyloſophy. And therefore, it is requiſite we ſhould looke ſomewhat more particularly into the manner how ſenſation is made.

Monſieur des Cartes (who by his great and heroyke attempts, and by ſhewing mankinde how to ſteere and husband their reaſon to beſt aduantage, hath left vs no excuſe for being ignorant of any thing worth the knowing) explicating the nature of ſenſe, is of opinion, that the bodies without vs, in certaine circumſtances, do giue a blow vpon our exterior organes: from whence, by the continuity of the partes, that blow or motion is continued, till it come to our braine and ſeate of knowledge; vpon which it giueth a ſtroke anſwerable to that, which the outward ſenſe firſt receiued: and there this knocke cauſing a particular effect, according to the particular nature of the motion (which dependeth off the nature of the obiect that produced it) our ſoule and mind hath notice, by this meanes, of euery thing that knocketh at our gates: and by the great variety of knockes or motions that our braine feeleth (which ariſeth from as great a variety of natures in the obiects that cauſe them) we are enabled, to iudge of the nature and conditions of euery thing we conuerſe withall.

As for example: he conceiueth light to be nothing elſe but a percuſſion made by the illuminant vpon the ayre, or vpon the ethereall ſubſtance, which he putteth to be mixed with, and to runne through all bodies: which being a continuate medium betweene the illuminant and our ſenſe; the percuſſion vpon that, ſtriketh alſo our ſenſe; which he calleth the nerue that reacheth from the place ſtrucken (to witt, from the bottome of our eye) vnto the braine. Now, by reaſon of the continuity of this ſtring or nerue, he conceiueth that the blow which is made vpon

the outward end of it by the ether, is conueyed by the other end of it to the braine; that end, striking the braine in the same measure as the ether strucke the other end of it: like the iacke of a virginall, which stricketh the sounding corde, according as the musitians hand presseth vpon the stoppe. The part of the braine which is thus struken, he supposeth to be the fantasie, where he deemeth the soule doth reside; and thereby taketh notice of the motion and obiect that are without. And what is said thus of sight, is to be applyed proportionably to the rest of the senses.

This then is the summe of Monsieur des Cartes his opinion, which he hath very finely expressed, with all the aduantages that opposite examples, significant wordes, and cleare methode can giue vnto a witty discourse. Which yet is but a part of the commendations he deserueth, for what he hath done on this particular. He is, ouer and aboue all this, the first that I haue euer mett with, who hath published any conceptions of this nature, whereby to make the operations of sense intelligible. Certainely, this prayse will euer belong vnto him, that he hath giuen the first hinte of speaking groundedly, and to the purpose vpon this subiect: and whosoeuer shall carry it any further (as what important mystery was euer borne and perfected at once?) must acknowledge to haue deriued his light from him.

2. The Authors opinion touching sensation.

For my part, I shall so farre agree with him, as to allow motion alone to be sufficient to worke sensation in vs: and not only to allow it sufficient, but also to professe, that not only this, but that no other effect whatsoeuer can be wrought in vs, but motion, and by meanes of motion. Which is euident out of what we haue already deliuered, speaking of bodies in generall; that all action among them, eyther is locall motion, or else followeth it: and no lesse euident, out of what we haue declared in particular, concerning the operations of the outward senses, and the obiects that worke vpon them: and therefore, whosoeuer shall in this matter, require any thing further then a difference of motion, he must first seeke other instruments in obiects to cause it. For, examining from their very origine, the natures of all the bodies we conuerse withall; we can not find any ground to beleeue they haue power or meanes to worke any thing beyond motion.

But I shall craue leaue to differ from him, in determining what is the subiect of this motion, whereby the braine iudgeth of the nature of the thing that causeth it. He will allow no locall change of any thing in a man, further then certaine vibrations of stringes, which he giueth the obiects to play vpon from the very sense vp to the braine: and by their different manners of shaking the braine, he will haue it know, what kind of thing it is, that striketh the outward sense, without remouing any thing within our body from one place to an other. But I shall goe the more common way; and make the spirits to be the porters of all newes to the braine: only adding therevnto that these newes

which

which they carry thither, are materiall participations of the bodies, that worke vpon the outward organes of the ſenſes; and paſſing through them, do mingle themſelues with the ſpirits, and ſo do goe whither they carry them, that is to the braine; vnto which, from all partes of the body, they haue immediate reſorte, and a perpetuall communication with it.

So that, to exerciſe ſenſe (which the latines do call, *ſentire*, but in English we haue no one word common to our ſeuerall particular notions of diuers perceptions by ſenſe) is, *Our braine to receiue an impreſsion from the externe obiect by the operation or mediation of an organicall part made for that purpoſe, and ſome one of thoſe which we terme an externe ſenſe; from which impreſsion, vſually floweth ſome motion proper to the liuing creature.* And thus you ſee that the outward ſenſes, are not truly ſenſes, as if the power of ſenſation were in them: but in an other meaning, to witt, ſo farre as they are inſtruments of qualifying or conueying the obiect to the braine.

Now, that the ſpirits are the inſtruments of this cõueyance, is euidẽt, by what we dayly ſee, that if a mã be very attẽtiue to ſome one externe obiect (as to the hearing or ſeeing of ſomething that much delighteth or diſpleaſeth him) he neyther heareth or ſeeth any thing but what his mind is bent vpõ; though all that while, his eyes and eares be open, and ſeuerall of their obiects be preſent, which at other times would affect him. For what can be the reaſon of this, but that the braine employing the greateſt part of his ſtore of ſpirits about that one obiect, which ſo powerfully entertayneth him, the others find very few free for them to imbue with their tincture? And therefore, they haue not ſtrength enough to giue the braine a ſufficient taſte of themſelues, to make it be obſerued; nor to bring themſelues into a place where they may be diſtinctly diſcerned: but ſtriuing to gett vnto it, they looſe themſelues in the throng of the others, who for that time do beſiege the braine cloſely. Whereas, in Monſieur des Cartes his way (in which no ſpirits are required) the apprehenſion muſt of neceſſity be carried preciſely according to the force of the motion of the externe obiect.

3. Reaſons to perſuade the authors opiniõ.

This argument I confeſſe, is not ſo conuincing a one againſt his opinion, but that the neceſſity of the conſequence may be auoyded; and an other reaſon be giuen for this effect, in Monſieur des Cartes his doctrine: for he may ſay, that the affection being vehemently bent vpon ſome one obiect, may cauſe the motion to be ſo violent by the addition of inward percuſſions, that the other coming from the outward ſenſe, being weaker, may be drowned by it; as leſſer ſoundes are by greater, which do forcibly carry our eares their way, and do fill them ſo entirely, that the others can not gett in to be heard: or as the drawing of one man that pulleth backewardes, is not felt when a hundred draw forwardes. Yet this is hard to conceiue, conſidering the great eminency which the preſent obiect hath ouer an abſent one, to make it ſelfe be felt:

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whence it followeth, that the multiplication of motion must be extremely encreased within, to ouertoppe and beare downe the motion, caused by a present obiect actually working without.

But that which indeed conuinceth me to beleeue I goe not wrong in this course, which I haue sett downe for externe bodies working vpon our sense and knowledgde: is first, the conuenience, and agreeablenesse to nature, both in the obiects and in vs, that it should be done in that manner: and next, a difficulty in Monsieur des Cartes his way, which me thinketh, maketh it impossible that his should be true. And then, his being absolutely the best of any I haue hitherto mett withall, and mine supplying what his falleth short in, and being sufficient to performe the effects we see: I shall not thinke I do amisse in beleeuing my owne to be true, till some body else shew a better.

4. That vitall spiritts are the immediate instruments of sensation by conueying sensible qualities to the braine.

Lett vs examine these considerations one after an other. It is manifest by what wee haue already established, that there is a perpetuall fluxe of litle partes or atomes out of all sensible bodies, that are composed of the foure Elements, and are here in the sphere of continuall motion by action and passion: and such it is, that in all probability these litle partes can not choose but gett in at the dores of our bodies, and mingle themselues with the spirits that are in our nerues. Which if they doe, it is vnauoydable, but that of necessity they must make some motion in the braine; as by the explication we haue made of our outward senses, is manifest: and the braine being the source and origine of all such motion in the animal, as is termed voluntary; this stroke of the obiect, will haue the power to cause some variation in its motions that are of that nature: and by consequence, must be a sensation, for, that change which being made in the braine by the obiect, is cause of voluntary motion in the animal, is that, which we call sensation.

But we shall haue best satisfaction, by considering how it fareth with euery sense in particular. It is plaine, that our touch or feeling is affected by the litle bodies of heate, or cold, or the like, which are squeesed or euaporated from the obiect; and do gett into our flesh, and cõsequently, do mingle themselues with our spirits: and accordingly, our hand is heated with the floud of subtile fire, which from a great one without, streameth into it: and is benummed with multitudes of litle bodies of cold, that settle in it. All which litle bodies, of heate, or of cold, or of what kind soeuer they be, when they are once gott in, must needes mingle themselues with the spirits they meet with in the nerue: and consequently, must goe along with them vp to the braine: for the channell of the nerue being so litle, that the most acurate inspectours of nature can not distinguish any litle cauity or hole running along the substance of it: and the spirits which ebbe and flowe in those channels, being so infinitely subtile, and in so small a quantity, as such chãnels can containe: it is euident, that an atome of insensible biggenesse, is sufficient to imbue the whole length and quantity of spirit that is in one nerue:

and

and that atome, by reaſon of the ſubtility of the liquor it is immerſed in, is preſently and as it were inſtantly, diffuſed through the whole ſubſtance of it: the ſource therefore of that liquor being in the braine, it can not be doubted, but that the force of the externe obiect, muſt needes affect the braine according to the quality of the ſaid atome: that is, giue a motion, or knocke, conformable to its owne nature.

As for our taſte, it is as plaine, that the litle partes expreſſed out of the body which affecteth it, do mingle themſelues with the liquour that being in the tongue, is continuate to the ſpirits: and then, by our former argument it is euident, they muſt reach vnto the braine. And for our ſmelling, there is nothing can hinder odours from hauing immediate paſſage vp to our braine, when by our noſe, they are once gotten into our head.

In our hearing, there is a litle more difficulty: for ſound being nothing but a motion of the ayre, which ſtriketh our eare; it may ſeeme more then needeth, to ſend any corporeall ſubſtance into the braine: and that it is ſufficient, that the vibrations of the outward ayre, shaking the drumme of the eare, do giue a like motion to the ayre within the eare, that on the inſide toucheth the tympane: and ſo this ayre, thus moued, shaketh and beateth vpon the braine. But this, I conceiue, will not ſerue the turne; for if there were no more, but an actuall motion, in the making of hearing; I do not ſee, how ſoundes could be conſerued in the memory: ſince of neceſſity, motion muſt alwayes reſide in ſome body; which argument, we ſhall preſſe anone, againſt Monſieur des Cartes his opinion for the reſt of the ſenſes.

5. How ſound is conueyed to the braine by vitall ſpirits.

Out of this difficulty, the very inſpection of the partes within the eare, ſeemeth to leade vs: for had there been nothing neceſſary beſides motion, the very ſtriking of the outward ayre againſt the tympanum, would haue been ſufficient without any other particular and extraordinary organization, to haue produced ſoundes, and to haue carried their motions vp to the braine: as we ſee the head of a drumme bringeth the motions of the earth vnto our eare, when we lay it therevnto, as we haue formerly deliuered. But Anatomiſtes, find other tooles and inſtruments, that ſeeme fitt to worke and forge bodies withall; which we can not imagine, nature made in vaine. There is a hammer and an anuile: whereof the hammer, ſtricking vpon the anuile, muſt of neceſſity beate off ſuch litle partes of the brainy ſteames, as flying about do light and ſticke vpon the toppe of the anuile: theſe by the trembling of the ayre following its courſe, can not miſſe of being carried vp to that part of the braine, wherevnto the ayre within the eare is driuen by the impulſe of the ſound: and as ſoone as they haue giuen their knocke, they rebound backe againe into the celles of the braine, fitted for harbours to ſuch winged meſſenger: where they remaine lodged in quietneſſe, till they be called for againe, to renew the effect which the ſound did make at the firſt: and the various blowes which the hammer ſtriketh, according to the various vibrations of the tympanum

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(vnto which the hammer is faſtened; and therefore is gouerned by its motiõs) muſt needes make great differẽce of biggeneſſes, and cauſe great variety of ſmartneſſes of motion, in the litle bodies which they forge.

6. How colours are conueyed to the braine by vitall ſpirits.

The laſt ſenſe is of ſeeing; whoſe action we can not doubt, is performed by the reflexion of light vnto our eye, from the bodies which we ſee: and this light, cometh impregnated with a tincture drawne from the ſuperficies of the obiect it is reflected from; that is, it bringeth along with it, ſeuerall of the litle atomes, which of themſelues do ſtreame, and it cutteth from the body it ſtrucke vpon and reboundeth from; and they, mingling themſelues with the light, do in company of it gett into the eye: whoſe fabrike, is fitt to gather and vnite thoſe ſpecies, as you may ſee by the anatomy of it: and from the eye, their iourney is but a short one to the braine: in which, we can not ſuſpect that they ſhould looſe their force; conſidering, how others that come from organes further off, do conſerue theirs: and likewiſe conſidering the nature of the optike ſpirits, which are conceiued to be the moſt refined of all that are in mans body.

Now, that light is mingled with ſuch litle atomes iſſuing out of the bodies from which it is reflected; appeareth euidently enough, out of what wee haue Sayed, of the nature and operations of fire and light: and it ſeemeth to be confirmed, by what I haue often obſerued in ſome chambers where people ſeldome come: which hauing their windowes to the ſouth, ſo as the ſunne lyeth vpon them a great part of the day in his greateſt ſtrength, and their curtaines being continually drawne ouer them, the glaſſe becometh dyed very deepe of the ſame colour the curtaine is of: which can proceed from no other cauſe, but that the beames which ſhoote through the glaſſe, being reflected backe from the courtaine, do take ſomething along with them from the ſuperficies of it; which being of a more ſolide corpulence then they, is left behind (as it were in the ſtrainer) when they come to preſſe themſelues through paſſages and pores, too litle for it to accompany them in: and ſo thoſe atomes of colour, do ſticke vpon the glaſſe which they can not penetrate.

An other confirmation of it is, that in certaine poſitions, the ſunne reflecting from ſtrong colours, will caſt that very colour vpon ſome other place; as I haue often experienced in liuely ſcarlet, and cloth of other ſmart colours: and this, not in that gloating wiſe, as it maketh colours of pure light, but like a true reall dye; and ſo, as the colour will appeare the ſame to a man, whereſoeuer he ſtandeth.

7. Reasõs againſt Monſieur des Cartes his opinion.

Hauing thus shewed in all our ſenſes, the conueniency and agreeableneſſe of our opinion with nature; (which hath been deduced, out of the nature of the obiects, the nature of our ſpirits, the nature and ſituation of our nerues, and laſtly from the property of our braine:) our next conſideration shall be, of the difficulty that occurreth in Mr. des Cartes his opinion. Firſt we know not how to reconcile the repugnãcies appearing

appearing in his position of the motion of the Ether; especially in light: for that Ethereall substance being extreme rare, must perforce be eyther extreme liquid, or extreme brittle: if the first; it can not choose but bowe and be pressed into fouldes, and bodies of vnequall motions, swimming euery where in it: and so it is impossible, that it should bring vnto the eye any constant apparition of the first mouer.

But lett vs suppose there were no such generall interruptions, euery where encountring, and disturbing the conueyance of the first simple motion: yet, how can we conceiue that a push, giuen so farre off, in so liquid an element, can continue its force so farre? We see that the greatest thunders and concussions, which at any time happen among vs, can not driue and impart their impulse the ten thousandeth part of the vast distance, which the sunne is remoued from our eye; and can we imagine, that a little touch of that luminous body, should make an impression vpon vs, by mouing an other so extremely liquid and subtile, as the Ether is supposed; which like an immense Ocean, tossed with all varieties of motion, lyeth betweene it and vs.

But admitt there were no difficulty nor repugnance in the medium, to conuey vnto vs a stroke, made vpon it by the sunnes motion: lett vs at the least examine, what kind of motions we must allow in the sunne, to cause this effect. Certainely, it must needes be a motion towardes vs, or else it can not stricke and driue the medium forward, to make it stricke vpon vs. And if it be so, eyther the sunne must perpetually be coming neerer and neerer to vs; or else it must euer and anone be receding backwardes, as well as mouing forwardes. Both which, are too chymericall for so great a witt to conceite.

Now, if the Ether be brittle, it must needes reflect vpon euery rubbe it meeteth with in its way, and must be broken and shiuered by euery body that moueth acrosse it: and therefore, must alwayes make an vncertaine and most disorderly percussion vpon the eye.

Then againe; after it is arriued to the sense, it is no wayes likely it should be conueyed from thence to the braine, or that nature intended such a kind of instrument as a nerue, to continue a precise determinate motion: for if you consider how a lute string, or any other such medium conueyeth a motion made in it; you will find, that to do it well and clearely, it must be stretched throughout to its full extent, with a kind of stiffenesse: whereas our nerues are not straight, but lye crooked in our body; and are very lither, till vpon occasion spirits coming into them, do swell them out. Besides, they are bound to flesh, and to other partes of the body; which being cessible, must needes dull the stroake, and not permitt it to be carried farre. And lastly, the nerues are subiect to be at euery turne contracted and dilated, vpon their owne account, without any relation to the stroakes beating vpon them from an externe agent: which is by no meanes, a conuenient disposition for a body, that is to be the porter of any simple motion; which should alwayes lye watching in

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great quietneſſe, to obſerue ſcrupulouſly, and exactly the arrant he is to carry: ſo that for my part, I can not conceiue, nature intended any ſuch effect, by mediation of the ſinnewes.

8. That the ſymptomes of the palſie do no way confirme Monſieur des Cartes his opinion.

But Monſieur des Cartes endeauoureth to confirme his opinion, by what vſeth to fall out in palſies, when a man looſeth the ſtrength of mouing his handes, or other members, and neuertheleſſe retaineth his feeling: which he imputeth to the remaining intire of the ſtringes of the nerues, whiles the ſpirits are ſomeway defectiue. To this we may anſwere, by producing examples of the contrary in ſome men, who haue had the motion of their limbes intire and no wayes preiudiced, but haue had no feeling at all, quite ouer their whole caſe of skinne and flesh: as particularly a ſeruant in the colledge of Phyſitians in London, whom the learned Haruey (one of his Maſters) hath told me, was exceeding ſtrong to labour, and very able to carry any neceſſary burthen, and to remoue thinges dexterouſly, according to the occaſion: and yet he was ſo voyde of feeling that he vſed to grind his handes againſt the walles, and againſt courſe lumber, when he was employed to rummage any; in ſo much, that they would runne with bloud, through grating of the skinne, without his feeling of what occaſioned it.

In our way, the reaſon of both theſe conditions of people, (the paralitike, and the inſenſible) is eaſy to be rendered: for they proceed out of the diuers diſpoſition of the animal ſpirits in theſe partes: which if they thicken too much, and become very groſſe, they are not capable of tranſmitting the ſubtile meſſengers of the outward world, vnto the tribunall of the braine, to iudge of them. On the other ſide, if they be too ſubtile, they neyther haue, nor giue power to ſwell the skinne, and ſo to draw the muſcles to their heades. And ſurely Monſieur des Cartes taketh the wrong way, in the reaſon he giueth of the palſie: for it proceedeth out of aboundance of humors; which clogging the nerues, rendreth them washy, and maketh them looſe their dryneſſe, and become lither, and conſequently, vnfitt and vnable, in his opinion, for ſenſation (which requireth ſtiffeneſſe) as well as for motion.

9. That Monſieur des Cartes his opinió, can not giue a good account, how thinges are cõſerued in the memory.

Yet beſides all theſe, one difficulty more remayneth againſt this doctrine, more inſuperable (if I miſtake not) then any thing, or all together we haue yet ſaid: which is, how the memory shoûld conſerue any thing in it, and repreſent bodies to vs, when our fanſie calleth for them, if nothing but motions do come into the braine. For it is impoſſible, that in ſo diuiſible a ſubiect as the ſpirits, motion should be conſerued any long time: as we ſee euidently in the ayre; through which moue a flaming taper neuer ſo ſwiftly, and as ſoone as you ſett it downe, almoſt in the very inſtant, the flame of it leaueth being driuen or shaken on one ſide, and goeth quietly and euenly vp its ordinary courſe: thereby shewing, that the motion of the ayre, which for the time was violent, is all of a ſoddaine quieted and at reſt: for otherwiſe, the flame of the taper would blaze that way the ayre were moued. Aſſuredly, the bodies

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that haue power to conſerue motion long, muſt be dry and hard ones. Nor yet can ſuch, conſerue it very long, after the cauſe which made it, ceaſeth from its operation. How then can we imagine, that ſuch a multitude of pure motions, as the memory muſt be ſtored withall for the vſe and ſeruice of a man, can be kept on foote in his braine, without confuſion: and for ſo long a time as his memory is able to extend vnto? Conſider a leſſen played vpon the lute or virginals; and think with your ſelfe, what power there is, or can be in nature, to conſerue this leſſon euer continually playing: and reflect, that if the impreſſions vpon the common ſenſe are nothing elſe but ſuch thinges, then they muſt be actually conſerued, alwayes actually mouing in our head, to the end they be immediately produced, whenſoeuer it pleaſeth our will to call for them.

And if peraduenture it should be replyed, that it is not neceſſary the motions themſelues should alwayes be conſerued in actuall being; but that it is ſufficient there be certaine cauſes kept on foote in our heades, which are apt to reduce theſe motions into act, whenſoeuer there is occaſion of them: all I shall ſay herevnto is, that this is meerely a voluntary poſition, and that there appeareth no ground, for theſe motions to make and conſtitute ſuch cauſes; ſince we neyther meete with any inſtruments, nor diſcouer any ſignes, whereby we may be induced to beleeue or vnderſtand any ſuch operation.

It may be vrged, that diuers ſoundes are by diſeaſes oftentimes made in our eares, and appearances of colours in our fantaſie. But firſt, theſe colours and ſoundes, are not artificiall ones, and diſpoſed and ordered by choice and iudgement; for no ſtory hath mentioned, that by a diſeaſe any man euer heard twenty verſes of Virgil, or an ode of Horace in his eares: or that euer any man ſaw faire pictures in his fanſye, by meanes of a blow giuen him vpon his eye. And ſecondly, ſuch colours and ſoundes as are obiected, are nothing elſe, but (in the firſt caſe) the motion of humours in a mans eye by a blow vpon it; which humours haue the vertue of making light, in ſuch ſort as we ſee ſea water hath, when it is clashed together: and (in the ſecond caſe) a cold vapour in certaine partes of the braine, which cauſeth beatinges or motion there; whence proceedeth the imitation of ſoundes: ſo that theſe examples do nothing aduantage that party, thence to inferre that the ſimilitudes of obiects, may be made in the common ſenſe, without any reall bodies reſerued for that end.

Yet I intend not to exclude motion from any commerce with the memory: no more then I haue done from ſenſation. For I will not only graunt, that all our remembring is performed by the meanes of motion; but I will alſo acknowledge, that (in men) it is, for the moſt part, of nothing elſe but of motion. For what are wordes, but motion? And wordes are the chiefeſt obiects of our remembrance. It is true, we can, if we will, remember thinges in their owne ſhapes, as well as by the wordes

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that expreſſe them;but experience telleth vs,that in our familiar conuerſation,and in the ordinary exerciſe of our memory, we remember and make vſe of the wordes,rather then of the thinges themſelues.

Beſides,the impreſſions which are made vpon all our other ſenſes, as well as vpon our hearing, are likewiſe for the moſt part of thinges in motion:as if we haue occaſion to make a conception of a man, or of a horſe,we ordinarily conceiue him walking, or ſpeaking,or eating, or vſing ſome motion in time: and as theſe impreſſions are ſucceſſiuely made vpon the outward organes;ſo are they ſucceſſiuely carried into the fantaſie, and by like ſucceſſion, are deliuered ouer into the memory: from whence, when they are called backe againe into the fantaſie, they moue likewiſe ſucceſſiuely;ſo that in truth,all our memory will be of motion; or at the leaſt, of bodies in motion: yet it is not chiefly of motion, but of the thinges that are moued; vnleſſe it be, when we remember wordes: and how thoſe motions, do frame bodies which moue in the braine, we haue already touched.

THE THREE AND THERTIETH CHAPTER.

Of Memory.

1. How thinges are cõſerued in the memory.

BVt how are theſe thinges conſerued in the braine? And how do they reuiue in the fantaſie, the ſame motions by which they came in thither at the firſt? Monſieur des Cartes hath putt vs in hope of an explication: and were I ſo happy,as to haue ſeene that worke of his, which the world of learned men ſo much longeth for; I aſſure my ſelfe,I ſhould herein receiue great helpe and furtherance by it. Although withall, I muſt profeſſe, I can not vnderſtand how it is poſſible, that any determinate motion should long be preſerued vntaynted in the braine; where there muſt be ſuch a multitude of other motions in the way,to mingle with it, and bring all into confuſion. One day I hope this iewell will be expoſed to publike view,both to do the Author right,and to inſtruct the world.

In the meane time,lett vs ſee what our owne principles afford vs. We haue reſolued,that ſenſation is not a pure driuing of the animal ſpirits, or of ſome penetrable body in which they ſwimme,againſt that part of the braine, where knowledge reſideth:but that it is indeed the driuing thither of ſolide materiall bodies (exceeding litle ones) that come from the obiects thẽſelues. Which poſition,if it be true,it followeth that theſe bodies muſt rebound from thence vpon other partes of the braine; where at the length, they find ſome vacant cell, in which they keepe their rankes and files, in great quiett and order; all ſuch ſticking together, and keeping company with one an other, that entered in together:

together: and there they lye still and are at rest, vntill they be stirred vp, eyther by the naturall appetite, (which is the ordinary course of beastes) or by chance, or by the will of the man in whom they are, vpon the occasions he meeteth with of searching into them. Any of these three causes rayseth them vp, and giueth them the motion that is proper to them; which is the same with that, whereby they came in at the first: for (as Galilæus teacheth vs) euery body hath a particular motion peculiarly proper to it, when nothing diuerteth it: and then they slide successiuely, through the fantasie in the same manner, as when they presented themselues to it the first time. After which, if it require them no more; they returne gently to their quiett habitation in some other part of the braine, from whence they were called and summoned by the fantasies messengers, the spirits: but if it haue longer vse of them, and would view them better then once passing through permitteth; then they are turned backe againe, and lead a new ouer their course, as often as is requisite: like a horse, that a rider paceth sundry times along by him that he sheweth him to; whiles he is attentiue to marke euery part and motion in him.

2. How thinges cõserued in the memory are brought backe in to the fantasie.

But lett vs examine a litle more particularly, how the causes we haue assigned, do raise these bodies that rest in the memory, and do bring them to the fantasie. The middlemost of them (namely chance) needeth no looking into, because the principles that gouerne it are vncertaine ones. But the first, and the last (which are, the appetite, and the will) haue a power (which we will explicate hereafter) of mouing the braine and the nerues depending of it, conueniently and agreably to their disposition. Out of which it followeth, that the litle similitudes, which are in the caues of the braine wheeling and swimming about (almost in such sort, as you see in the washing of currantes or of rise, by the winding about and circular turning of the cookes hand) diuers sortes of bodies do go their courses for a pretty while; so that the most ordinary obiects, can not choose but present themselues quickely, because there are many of them, and are euery where scattered about: but others that are fewer, are longer ere they come in view: much like as in a paire of beades, that containing more litle ones then great ones, if you plucke to you the string they all hang vpon, you shall meete with many more of one sort, then of the other.

Now, as soone as the braine hath lighted on any of those it seeketh for, it putteth as it were a stoppe vpon the motion of that; or at the least, it moueth it so, that it goeth not farre away, and is reuocable at will: and seemeth like a baite to draw into the fantasie others belonging vnto the same thing, eyther through similitude of nature, or by their connexion in the impression: and by this meanes hindereth other obiects, not pertinent to the worke the fansie hath in hand, from offering themselues vnseasonably in the multitudes that otherwise they would do. But if the fansie should haue mistaken one obiect for an other, by reason of some

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reſemblance they haue betweene themſelues; then it shaketh againe the liquid medium they all floate in, and rooſeth euery ſpecies lurking in remoteſt corners, and runneth ouer the whole beaderoule of them: and continueth this inquiſition and motion, till eyther it be ſatisfyed with retriuing at length what it required, or that it be growne weary with toſſing about the multitude of litle inhabitants in its numerous empire, and ſo giueth ouer the ſearch, vnwillingly and diſpleaſedly.

3. A Confirmatiõ of the former doctrine.

Now, that theſe thinges be as we haue declared, will appeare out of the following conſiderations; firſt, we ſee that thinges of quite different natures, if they come in together, are remembred together: vpon which principle the whole art of memory dependeth: ſuch thinges, can not any way be compriſed vnder certaine heades, nor be linked together by order and conſequence, or by any reſemblance to one an other: and therefore all their connexion muſt be, that as they came in together into the fantaſie, ſo they remaine together in the ſame place in the memory: and their firſt coupling, muſt proceed from the action that bound them together, in driuing them in together.

Next, we may obſerue, that when a man ſeeketh and tumbleth in his memory for any thing he would retriue, he hath firſt ſome common and confuſed notion of it: and ſometimes he hath a kind of flasking or fadeing likeneſſe of it; much what, as when in ſtriuing ro remember a name, men vſe to ſay, it is at their tongues end: and this sheweth, that he attracteth thoſe thinges he deſireth, and hath vſe of, by the likeneſſe of ſomething belonging to them. In like manner, when hunger maketh one think of meat, or thirſt maketh one dreame of drinke, or in other ſuch occaſions, wherein the naturall appetite ſtirreth obiects in the memory and bringeth thẽ to the fantaſie; it is manifeſt, that the ſpirits informing the braine of the defect and paine, which ſeuerall partes of the body do endure, for want of their due nourishment; it giueth a motion to the hart, which ſendeth other ſpirits vp to ſupply the braine, for what ſeruice it will order them: by which, the braine being fortifyed, it followeth the purſuite of what the liuing creature is in want of; vntill the diſtempered partes be reduced into their due ſtate, by a more ſolide enioying of it.

4. How thinges renewed in the fantaſie, returne with the ſame circumſtãces that they had at firſt.

Now, why obiects that are drawne out of the memory, do vſe to appeare in the fantaſie, with all the ſame circumſtances which accompanyed them at the time when the ſenſe did ſend them thither, (as when in the remembrance of a frend, we conſider him in ſome place, and at a certaine time, and doing ſome determinate action) the reaſon is, that the ſame body, being in the ſame medium, muſt neceſſarily haue the ſame kind of motion; and ſo conſequently, muſt make the ſame impreſſion vpon the ſame ſubiect. The medium which theſe bodies moue in (that is, the memory) is a liquid vaporous ſubſtance, in which they floate and ſwimme at liberty.

Now, in ſuch a kind of medium, all the bodies that are of one nature, will eaſily gather together, if nothing diſturbe them: for as when a tuned lute ſtring is ſtrucken, that ſtring by communicating a determinate

ſpecies

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ſpecies of vibration to the ayre round about it, shaketh other ſtringes, within the compaſſe of the moued ayre; not all, of what extent ſoeuer, but only ſuch, as by their naturall motion, would cauſe like curlinges, and fouldes in the ayre, as the other doth; according to what Galileus hath at large declared: euen ſo, when ſome atome in the braine is moued, all the reſt there about, which are apt to be wafted with a like vndulation, muſt needes be moued in chiefe: and ſo they mouing, whiles the others of different motions, that hauing nothing to rayſe them, do eyther lye quiett or moue very litle in reſpect of the former; it is no wonder if they aſſemble together; and (by the proper courſe of the braine) do meete at the common rendez-vous of the fantaſie.

5. How the memory of thinges paſt is loſt, or confounded: and how it is repaired againe.

And therefore the more impreſſions, that are made from the ſame obiect vpon the ſenſe; the more participations of it, will be gathered together in the memory: and the ſtronger impreſſions, it will vpon occaſion make in the fantaſie: and themſelues will be the ſtrōger to reſiſt any cauſe that shall ſtriue to deface them. For we ſee that multitude of obiects, ouerwhelmeth the memory; and putteth out, or at the leaſt, maketh vnprofitable, thoſe that are ſeldomſt thought on. The reaſon of which is, that they being litle in quantity, becauſe there are but few ſpecies of them; they can neuer ſtrike the ſeate of knowledge, but in company of others; which being more and greater, do make the impreſſion follow their nature againſt the leſſer: and in tract of time, thinges ſeldome thought of, do grow to haue but a maimed and cōfuſed shape in the memory; and at length are quite forgotten. Which happeneth, becauſe in the liquid medium, they are apt to moulder away, if they be not often repaired: which mouldring and defacing, is helped on by the shockes they receiue from other bodies: like as in a magaſin, a thing that were not regarded, but were careleſſely tumbled vp and downe, to make roome for others, and all thinges were promiſcuouſly throwne vpon it; it would ſoone be bruſed and crushed into a miſſeshapen forme, and in the end be broken all in pieces.

Now, the repairing of any thing in the memory, is done, by receiuing new impreſſions from the obiect; or in its abſence, by thinking ſtrongly of it: which is an aſſembling, and due peecing together of the ſeuerall particles of bodies, appertayning to the ſame matter. But ſometimes it happeneth, that when the right one can not be found intire, nor all the orderly pieces of it, be retriued with their iuſt correſpondance to one an other; the fanſie maketh vp a new one in the place of it: which afterwardes, vpon preſence of the obiect, appeareth to haue been miſtaken: and yet the memory, till then, keepeth quietly and vnqueſſionedly for the true obiect, what either, the thought, or chance, mingling ſeuerall partes, had patched vp together.

And from hence, we may diſcerne, how, the looſing or confounding of ones memory, may happen eyther by ſickneſſe, that diſtemper the ſpirits in the braine, and diſorder their motions; or by ſome blowes on

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the head, whereby a man is astonied, and all thinges seeme to turne round with him. Of all which effects, the causes are easy to be found in these suppositions we haue layed.

THE FOVRE AND THERTIETH CHAPTER:

Of voluntary motion: Naturall faculties: and passions.

1. Of what matter the braine is composed.

HItherto we haue laboured to conuey the obiect into the braine: but when it is there, lett vs see what further effects it causeth: and how that action, which we call *Voluntary motion*, doth proceed from the braine For the discouery whereof, we are to note, that the braine is a substance composed of watry partes mingled with earthy ones: which kind of substances we see are vsually full of stringes: and so in strong hard beere, and in vinegar, and in other liquors of the like nature, we see (if they be exposed to the sunne) little long flakes, which make an appearance of wormes or magates floating about. The reason whereof is, that some drye partes of such liquors, are of themselues as it were hairy or sleasy, that is, haue litle downy partes, such as you see vpon the legges of flies, or vpon caterpillars, or in little lockes of woole; by which they easily catch and sticke to other little partes of the like nature, that come neere vnto them: and if the liquor be moued, (as it is in the boyling of beere, or making of vinegar by the heate of the sunne) they become long stringes; because the liquor breaketh the ties which are crosse to its motion: but such as lye along the streame, or rather the bubling vp, do maintaine themselues in vnity, and peraduenture grow stronger, by the winding or foulding of the end of one part with an other: and in their tumbling and rouling still in the same course, the downy haires are crushed in, and the body groweth long and round, as happeneth to a lumpe of dough, or waxe, or woole, rouled a while in one vniforme course. And so, coming to our purpose, we see that the braine, and all that is made of it, is stringy; witnesse, the membranes, the flesh, the bones, &c. But of all the rest, those which be called fibers, are most stringy: and the nerues seeme to be but an assembly of them: for although the nerues be but a great multitude of stringes lying in a cluster; neuertheless, by the consent of Physitians and Anatomistes, they are held to be of the very substance of the braine, dryed to a firmer consistence then it is in the head.

This heape of stringes (as we may call it) is enclosed in an outside made of membranes; whose frame, we needle not here display: only we may note, that it is very apt and fitt to stretch; and after stretching, to returne againe to its owne iust length. Next, we are to consider, how the braine is of a nature apt to swell and to sinke againe: euen so much, that Fallopius reporteth, it doth swell according to the encrease of the moone: which whether

whether it be true or no; there can be no doubt, but that it being of a substance which is full of skinnes and stringes, is capable of being stretched, and of swelling vpon light occasions; and of falling or sinking againe vpon as light: as being easily penetrable by vapours and by liquors, whose nature it is, to swell and to extend that which they enter into. Out of which it followeth, that it must be the nature of the nerues to do the like: and indeed, so much the more, by how much more drie they are then the braine: for we see that (to a certaine measure) drier thinges are more capable of extension by the ingression of wett, then moist thinges are; becausse these are not capable of receiuing much more wett into them.

2. What is voluntary motion.

These thinges being premised; lett vs imagine that the braine being first swelled, it doth afterwardes contract it selfe; and it must of necessity follow, that seeing the nerues are all open towardes the braine (though their concauities can not be discerned) the spirits and moysture which are in the braine, must needes be pressed into the nerues: which being allready stored with spirits, sufficiently to the proportion of their hard skinnes; this addition will make them swell and grow hard, as a balloone doth, which being competently full of ayre, hath neuertheless more ayre pressed into it.

Since therefore, the masters of Anatomy do teach vs, that in euery muscle there is a nerue, which is spread into a number of litle branches along that muscle; it must follow, that if these litle branches be swollen, the flesh likewise of that muscle, must also needes be swollen. Now the muscle hauing both its endes fastened, the one in a greater bone, the other in a lesser; and there being least resistance on that part, where the bone is lesser, and more moueable; the swelling of the muscle can not choose, but draw the litle bone towardes the great one; and by consequence, moue that litle bone: and this is that, which Philosophers vsually call *Voluntary motion*: for since our knowledge remaineth in the braine, whatsoeuer is done by knowledge, must be done by the braine; and most of what the braine worketh for the common seruice of the liuing creature, proceedeth also from knowledge; that is, from the motion of the fansy, which we haue expressed.

3. What those powers are which are called naturall faculties.

This matter being thus farre declared, we may now enter vpon the explication of certaine effects; which peraduenture might haue challenged roome, in the precedent Chapter; but indeed, could not well be handled without first supposing this last discourse: and it is, what is meaned by those powers, that are called naturall faculties: the which howsoeuer in their particulars they be manifold in a liuing creature, yet whensoeuer any one of them is resolued, it appeareth to be compounded of some of these fiue; to witt, the attractiue, the retentiue, the secretiue the concoctiue, and the expulsiue faculty.

Of which, the attractiue, the secretiue, and the concoctiue do not seeme to belong vnto the nerues, for although we may conceiue that

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the part of the animal doth turne it selfe towardes the thing which it attracteth; neuertheleſſe, that very turning ſeemeth not to be done by vertue of the muſcles, and of the nerues, but rather in a naturall way, as the motion of the hart is performed, in ſuch ſort as we haue formerly declared: as for example, if the ſtomacke when it is greedy of meate, draweth it ſelfe vp towardes the throate, it ſeemeth rather to be a kind of dryneſſe and of warping, ſuch as we ſee in bladders or in leather eyther by fire or by cold, which make them shriuell vp and grow hard; then that it is a true faculty of the liuing creature to ſeeke after meate.

4. How the attractiue and ſecretiue faculties, worke.

Nor need we extend our diſcourſe any further about theſe three faculties; ſeeing that we haue already declared in common, how attraction, drying, and mixture of actiue bodies with paſſiue ones, is performed; which needeth but applying vnto theſe particulars, to explicate fully their natures: as for example; if the kidneyes draw the matter of vrine vnto them out of the veines, it may be by any of the following three manners, to witt, eyther by draught, wett, or by ſteame. For if the ſerous partes that are in the bloud which runneth in the veines, do touch ſome drie partes conformable to their nature, tending towardes the kidneyes; they will infallibly adhere more to thoſe drie partes, then to the reſt of the bloud. Which if they do in ſo great a quantity, that they reach to other further partes more drie then theſe, they will leaue the firſt partes to goe to the ſecond: and thus by litle, and litle, will draw a line of vrine from the bloud, if the bloud do abound with it: and the neerer it cometh to the kidneyes, the ſtronger ſtill the attraction will be.

The like will happen, if the ſeroſity which is in the bloud, do touch ſome part wetted with a like ſeroſity, or where ſuch hath lately paſſed; for as we ſee that water will runne more eaſily vpon a wett part of a board or a ſtone then vpon a drie one; ſo you can not doubt, but that if the ſerous part, which is mixed with the bloud, do light vpon a current of its owne nature, it will ſticke more to that, then to the current of the bloud; and ſo part from the bloud, to goe that way which the current of its owne nature goeth.

Beſides, it can not be doubted, but that from the kidneyes, and from the paſſages betweene the kidneyes and the veines, in which the bloud is conueyed, there ariſeth a ſteame: whoſe nature is, to incorporate it ſelfe with ſerous matter, out of whoſe body it hath been extracted. This ſteame therefore, flying ſtill to the ſerous bloud which paſſeth by, muſt of neceſſity precipitate (as I may ſay) the ſerous partes of that bloud: or rather muſt filter them out of their maine ſtocke; and ſo will make them runne in that currēt, from which it ſelfe doth flow. And thus you ſee how *Attraction* and *Secretion* are made: for the drawing of the ſeroſity without drawing the bloud, is the parting of the vrine from the bloud. And this example, of the kidneyes operation, may be applyed to the attractions of all the other partes.

Now

Now, the concoctiue faculty (which is the laſt of the three we tooke together) conſiſteth of two partes: the one is, as it were a drying of the humour, which is to be concocted; the other is, a mingling the ſubſtance of the veſſell in which the humour is concocted, with the humour it ſelfe: for as if you boyle diuers kindes of liquors in braſſe pannes, the pannes will taynt the liquor with the quality of the braſſe; and therefore Phyſitians forbid the vſe of ſuch, in the boyling of ſeuerall medicines: ſo much more in a liuing creatures body, there can be no doubt, but that the veſſell in which any humour is concocted, doth giue a tincture therevnto. Now concoction conſiſting in theſe two, it is euident, what the concoctiue vertue is; to witt, heate, and the ſpecificall property of the veſſell which by heate is mingled with the humour. 5. Concerning the concoctiue faculty.

There remaine yet, the retentiue and the expulſiue faculties to be diſcourſed of. Whereof one kind, is manifeſtly belonging to the voluntary motion which we haue declared: namely that retention, and that expulſion, which we ordinarily make of the groſſe excrements eyther of meate, or of drinke, or of other humours, eyther from our head, or from our ſtomacke, or from our lungs; for it is manifeſtly done, partly by taking in of winde, and partly by compreſſing of ſome partes and opening of others: as Galen sheweth in his curious booke *de vſu partium*. 6. Concerning the retentiue and expulſiue faculties.

An other kind of retention and expulſion, in which we haue no ſenſe when it is made, (or if we haue, it is of a thing done in vs without our will, though peraduenture we may voluntarily aduance it) is made by the ſwelling of fibers in certaine partes, through the confluence of humours to them, (as in our ſtomacke it happeneth, by the drinke and the iuice of the meate that is in it) which ſwelling, cloſeth vp the paſſages by which the contained ſubſtance should goe out (as the moyſtening of the ſtringes, and mouth of a purſe, almoſt shutteth it) vntill in ſome (for example the ſtomacke, after a meale) the humour being attenuated by little and little, getteth out ſubtilely; and ſo leauing leſſe weight in the ſtomacke, the bag which weighth downe lower, then the neather orifice at which the digeſted meate iſſueth, riſeth a little: and this riſing of it, is alſo furthered by the wrinkling vp and shortning of the vpper part of the ſtomacke; which ſtill returneth into its naturall corrugation, as the maſſe of liquid meate leaueth ſoaking it (which it doth by degrees, ſtill as more and more goeth out; and ſo what remaineth filleth leſſe place, and reacheth not ſo high of the ſtomacke:) and thus at lēgth, the reſidue and thicker ſubſtance of the meate, after the thinneſt is gott out in ſteame, and the middling part is boyled ouer in liquor, cometh to preſſe and grauitate wholy vpō the orifice of the ſtomacke; which being then helped by the figure and lying of the reſt of the ſtomacke, and its ſtringes and mouth relaxing, by hauing the iuice which ſwelled them, ſqueezed out of them; it openeth it ſelfe, and giueth way vnto that which lay ſo heauy vpon it, to tumble out. In others (for example, in a woman with childe) the encloſed ſubſtāce, (retained firſt by ſuch a courſe of nature as

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we haue ſett downe) breaketh it ſelfe a paſſage by force, and openeth the orifice at which it is to goe out by violence, when all circumſtances are ripe according to natures inſtitution.

7. Concerning expulſion made by Phyſicke.

But yet there is the expulſion which is made by phyſicke, that requireth a little declaration. It is of fiue kindes: vomiting, purging by ſtoole, by vrine, ſweating, and ſaliuation. Euery one of which, ſeemeth to conſiſt of two partes, namely the diſpoſition of the thing to be purged, and the motion of the nerues or fibers for the expulſion: as for example, when the Phyſitian giueth a purge, it worketh two thinges; the one is, to make ſome certaine humour more liquid and purgeable thē the reſt; the other is, to make the ſtomacke or belly, ſucke or vent this humour. For the firſt, the property of the purge muſt be, to precipitate that humour out of the reſt of the bloud; or if it be thicke, to diſſolue it that it may runne eaſily. For the ſecond, it ordinarily heateth the ſtomacke; and by that meanes, it cauſeth the ſtomacke to ſucke out of the veines, and ſo to draw from all partes of the body. Beſides this, it ordinarily filleth the belly with winde, which occaſioneth thoſe gripings men feele when they take phyſicke; and is cauſe of the guttes diſcharging thoſe humours, which otherwiſe they would retaine.

The like of this happeneth in ſaliuation; for the humours are by the ſame meanes brought to the ſtomacke, and thence ſublimed vp to be ſpitten out: as we ſee in thoſe, who taking Mercury into their body, eyther in ſubſtance or in ſmoake, or by applicatiō, do vent cold humours from any part; the Mercury riſing from all the body vp to the mouth of the patient, as to the helme of a ſublimatory: and the like ſome ſay of Tobacco.

As for vomiting, it is in a manner wholy the operation of the fibers, prouoked by the feeling of ſome inconuenient body, which maketh the ſtomacke wrincle it ſelfe, and worke and ſtriue to caſt out what offendeth it.

Sweating ſeemeth to be cauſed, by the heating of ſome introus body by the ſtomake; which being of ſubtile partes, is by heate diſperſed from the middle to the circumference; and carrieth with it light humours, which turne into water as they come out into the ayre. And thus you ſee in generall, and as much as concerneth vs to declare, what the naturall faculties are: and this, according to Galen his owne mind: who affirmeth, that theſe faculties do follow the complexion, or the temper of the partes of a mans body.

How the braine is moued to worke voluntary motion.

Hauing explicated how voluntary motion proceedeth from the braine: our next conſideration ought to be, to examine what it is, that ſuch an obiect, as we brought, by meanes of the ſenſes, into the braine from without, doth contribute to make the braine apply it ſelfe to worke ſuch voluntary motion. To which purpoſe, we will goe a ſteppe or two backe, to meete the obiect at its entrance into the ſenſe; and from thence accompany it in all its iourney and motions onwardes. The obiect which

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ſtriketh at the ſenſes dore, and getting in, mingleth it ſelfe with the ſpirits it findeth there; is eyther cõforme and agreeable to the nature and temper of thoſe ſpirits, or it is not: that is to ſay in short, it is eyther pleaſing or diſpleaſing to the liuing creature, or it may be of a third kind, which being neyther of theſe, we may terme indifferent. In which ſort ſoeuer the obiect affect the ſenſe, the ſpirits carry it immediately to the braine; vnleſſe ſome diſtemper or ſtrong thought, or other accident hinder them.

Now, if the obiect be of the third kind; that is, be indifferent; as ſoone as it hath ſtrucken the braine, it reboundeth to the circle of the memory: and there, being ſpeedily ioyned to others of its owne nature, it findeth them annexed to ſome pleaſing or diſpleaſing thing, or it doth not: if not, in beaſtes it ſerueth to little vſe: and in men, it remayneth there vntill it be called for. But if, eyther in its owne nature, it be pleaſing or diſpleaſing; or afterwardes, in the memory it became ioyned to ſome pleaſing or annoying fellowshipp; preſently, the hart is ſenſible of it: for the hart being ioyned to the braine by ſtraight and large nerues, full of ſtrong ſpirits which aſcend from the hart; it is impoſſible, but that it muſt haue ſome communication with thoſe motions, which paſſe in the braine: vpon which the hart, or rather the ſpirits about it, is eyther dilated or compreſſed.

And theſe motions, may be eyther totally of one kind, or moderated, and allayed by the mixture of its contrary: if of the former ſort; one of them we call *ioy*, the other *griefe*; which do continue about the hart (and peraduenture do oppreſſe it if they be in the vtmoſt extremity) without ſending any due proportion of ſpirits to the braine vntill they ſettle a little, and grow more moderate.

Now, when theſe motions are moderate; they immediately ſend vp ſome aboundance of ſpirits to the braine: which if they be in a conuenient proportion, they are by the braine thruſt into ſuch nerues as are fitt to receiue them: and ſwelling them, they giue motion to the muſcles and tendons that are faſtened to them: and they do moue the whole body, or what part of it is vnder command of thoſe nerues, that are thus filled and ſwelled with ſpirits by the braine.

If the obiect was conformable to the liuing creature, then the braine ſendeth ſpirits into ſuch nerues, as carry the body to it: but if otherwiſe, it cauſeth a motiõ of auerſion or flight from it. To the cauſe of this latter, we giue the name of *Feare*: and the other, that carrieth one to the purſuite of the obiect, we call *Hope*. *Anger*, or *Audacity*, is mixed of both theſe; for it ſeeketh to auoyde an euill by embracing and ouercoming it: and proceedeth out of aboundance of ſpirits.

Now, if the proportion of ſpirits ſent from the hart, be too great for the braine, it hindereth or peruerteth the due operation both in man and beaſt.

All which it will not be amiſſe to open a litle more particularly: and

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9. Why pleasing obiects doe dilate the spirits, and displeasing ones contract them.

first; why painefull or displeasing obiects, do contract the spirits, and gratefull ones, do contrary wise, dilate them? It is, because the good of the hart consisteth in life, that is in heate and moysture: and it is the nature of heate, to dilate it selfe in moysture; whereas cold and drie thinges, do contract the bodies they worke vpon: and such are enemyes to the nature of men and beasts: and accordingly experience, as well as reason, teacheth vs, that all obiects, which be naturally good, are such as be hoat and moyst in the due proportion to the creature that is affected and pleased with them.

Now, the liuing creature being composed of the same principles as the world round about him is; and the hart being an abridgement of the whole sensible creature; and being moreouer full of bloud, and that very hoat; it cometh to passe, that if any of these little extracts of the outward world, do arriue to the hoat bloud about the hart, it worketh in this bloud such like an effect, as we see a droppe of water falling into a glasse of wine; which is presently dispersed into a competent compasse of the wine: so that any little obiect, must needes make a notable motion in the bloud about the hart.

This motion, according to the nature of the obiect, will be eyther conformable or contrary; vnlesse it be so little a one, as no effect will follow of it; and then, it is of that kind, which aboue we called indifferent. If the ensuing effect, be connaturall to the hart, there riseth a motion of a certaine fume about the hart; which motion we call *pleasure*; and it neuer fayleth of accompanying all those motions which are good, as *Ioy*, *Loue*, *Hope* and the like: but if the motion be displeasing; there is likewise a common sense of a heauynesse about the hart, which we call *griefe*: and it is common to *sorrow*, *feare*, *hate*, and the like.

Now it is manifest by experience, that these motions are all of them different ones, and do strike against diuers of those partes of our body which encompasse the hart: out of which striking followeth that the spirits sent from the hart, do affect the braine diuersly; and are by it, conueyed into diuers nerues, and so do sett diuers members in action. Whence followeth, that certaine members are generally moued vpon the motion of such a passion in the hart, especially in beastes, who haue a more determinate course of working, then man hath: and if sometimes we see variety, euen in beasts, vpon knowledge of the circumstances, we may easily guesse at the causes of that variety: the particularities of all which motions, we remitt to Physitians and to Anatomistes: aduertising only, that the fume of pleasure, and the heauinesse of griefe, do plainely shew, that the first motions do participate of dilatation, and the latter of compression.

10. Concerning the fiue senses for what vse and end they are.

Thus you see, how by the senses, a liuing creature becometh iudge of what is good, and of what is bad for him: which operation, is performed more perfectly in beasts; and especially in those, who liue in the free ayre,

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remote from humane conuerſation, (for their ſenſes are fresh and vntaynted, as nature made them) then in men. Yet without doubt nature hath beene as fauourable in this particular to men, as vnto them; were it not, that with diſorder and exceſſe, we corrupt and oppreſſe our ſenſes: as appeareth euidently by the ſtory we haue recorded of Iohn of Liege: as alſo by the ordinary practiſe of ſome Hermites in the deſerts, who by their taſt or ſmell, would preſently be informed whether the herbes, and rootes, and fruits they mett withall, were good or hurtfull for them, though they neuer before had had triall of them.

Of which excellency of the ſenſes, there remaineth in vs only ſome dimme ſparkes, in thoſe qualities which we call ſympathies and antipathies: whereof the reaſons are plaine, out of our late diſcourſe: and are nothing elſe, but a conformity or oppoſition of a liuing creature, by ſome indiuiduall property of it, vnto ſome body without it: in ſuch ſort, as its conformity or oppoſition vnto thinges by its ſpecificall qualities, is termed naturall or againſt nature. But of this we ſhall diſcourſe more at large hereafter.

Thus it appeareth, how the ſenſes are ſeated in vs, principally for the end of mouing vs to, or from obiects, that are good for vs, or hurtfull to vs. But though our Reader be content to allow this intent of nature, in our three inferiour ſenſes; yet he may peraduenture not be ſatisfyed, how the two more noble ones (the hearing and the ſeeing) do cauſe ſuch motions to, or from obiects, as are requiſite to be in liuing creatures for the preſeruation of them: for (may he ſay) how can a man, by only ſeeing an obiect, or by hearing the ſound of it, tell what qualities it is embued withall? Or what motion of liking or diſliking, can be cauſed in his hart, by his meere receiuing the viſible ſpecies of an obiect at his eyes, or by his eares hearing ſome noyſe it maketh? And if there be no ſuch motion there, what ſhould occaſion him, to proſecute or auoyd that obiect? When he taſteth, or ſmelleth, or toucheth a thing, he findeth it ſweet, or bitter, or ſtincking, or hoat, or cold; and is therewith eyther pleaſed or diſpleaſed: but when he only ſeeth or heareth it, what liking or diſliking can he haue of it, in order to the preſeruation of his nature?

The ſolution of this difficulty, may in part appeare out of what we haue already ſaid. But for the moſt part, the obiects of theſe two nobler ſenſes, do moue vs, by being ioyned in the memory with ſome other thing that did eyther pleaſe or diſpleaſe ſome of the other three ſenſes. And from thence it is, that the motion of going to embrace the obiect, or auerſion from it, doth immediately proceed: as when a dogg ſeeth a man that vſeth to giue him meate, the ſpecies of the man coming into his fanſie, calleth out of his memory the others which are of the ſame nature, and are former participations of that man, as well as this fresh one is: but theſe are ioyned with ſpecieſes of meate; becauſe at other times, they did vſe to come in together: and therefore the meate being a good vnto him, and cauſing him (in the manner we haue ſaid) to moue

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towardes it; it will follow that the dogg will presently moue towardes that man, and expresse a contentednesse in being with him. And this is the ground of all assuefaction in beasts, and of making them capable of receiuing any instructions.

THE FIVE AND THERTIETH CHAPTER.

Of the materiall instruments of Knowledge and Passion; of the seuerall effects of Passions; of Paine and Pleasure; and how the vitall spirits are sent from the braine into the intended partes of the body, without mistaking their way.

1. That *Septum Lucidum* is the seat of the fansie.

TO conclude this great businesse, which concerneth all the mutations and motions, that are made by outward Agents in a liuing creature, it will not be amisse, to take a short and generall suruay of the materiall instruments, which concurre to this effect. Whereof the braine being the principall, or at least, the first and next of the principalles; we may take notice that it containeth, towardes the middle of its substance, foure concauities, as some do count them: but in truth, these foure, are but one great concauity, in which, foure, as it were, diuers roomes, may be distinguished. The neather part of these concauities, is very vnequall, hauing ioyned vnto it, a kind of nett, wrought by the entangling of certaine litle arteries, and of small emanations from a *Sinus*, which are interwouen together. Besides this, it is full of kernels, which do make it yet more vneuen.

Now, two roomes of this great concauity, are diuided by a litle body, somewhat like a skinne, (though more fryable) which of it selfe is cleere; but there it is somewhat dimmed, by reason that hanging a litle slacke, it somewhat shriueleth together: and this, Anatomistes do call *Septum Lucidum*, or *speculum*; and is a different body from all the rest that are in the braine. This transparēt body, hangeth as it were straightwardes, from the forehead towards the hinder part of the head: and diuideth the hollow of the braine, as farre as it reacheth, into the right and the left ventricles.

This part seemeth to me, (after weighing all circumstances, and considering all the conueniencies, and fittenesses) to be that, and only that, in which the fansie or common sense resideth: though Monsieur des Cartes hath rather chosen a kernell to place it in. The reasons of my assertions are; first, that it is in the middle of the braine, which is the most conuenient situation to receiue the messages from all our body, that do come by nerues, some from before, and some from behind. Secondly, that with its two sides, it seemeth to be conueniently opposed to all such of our senses, as are double; the one of them sending its litle messengers or atomes, to giue it aduertissements on one side, the other on the other side;

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ſide; ſo that it is capable of receiuing impreſſion indifferently from both. Againe, by the nature of the body, it ſeemeth more fitt to receiue all differences of motion, then any other body neere it. It is alſo moſt cõformable to the nature of the eye; which being our principall outward ſenſe, muſt needes be in the next degree to that, which is eleuated a ſtraine aboue our outward ſenſes. Fiftly, it is of a ſingle and peculiar nature; whereas the kernels are many, and all of them of the ſame condition, quality, and appearance. Sixtly, it is ſeated in the very hollow of the braine; which of neceſſity muſt be the place and receptacle where the ſpecieſes and ſimilitudes of thinges do reſide; and where they are moued and tumbled vp and downe, when we thinke of many thinges. And laſtly, the ſituation we putt our head in, when we thinke earneſtly of any thing, fauoureth this opinion: for then we hang our head forwards, as it were forcing the ſpecieſes to ſettle towardes our forehead, that from thence they may rebound, and worke vpon this diaphanous ſubſtance.

This then ſuppoſed, lett vs conſider, that the atomes or likeneſſes of bodies, hauing giuen their touch vpon this *Septum* or *Speculum*, do thence retire backe into the concauities, and do ſticke (as by chance it happeneth) in ſome of the inequalities they encounter with there. But if ſome wind or forcible ſteame, ſhould breake into theſe caues, and as it were brush and ſweepe them ouer; it muſt follow, that theſe litle bodies will looſen themſelues, and beginne to play in the vapour which filleth this hollow place: and ſo floting vp and downe, come a new to ſtrike and worke vpon the *Speculum* or fantaſy: which being alſo a ſoluble body, many times theſe atomes ſtriking vpon it, do carry ſome litle corporeall ſubſtance from it ſticking vpon them: whence enſueth, that they returning againe with thoſe tinctures or participations of the very ſubſtance of the fantaſy; do make vs remember, not only the obiects themſelues, but alſo that we haue thought of them before.

2. What cauſeth vs to remẽber not only the obiect it ſelfe, but alſo that we haue thought of it before.

Further we are to know, that all the nerues of the braine, haue their beginnings not farre of from this *ſpeculum*: of which we shall take a more particular conſideration of two, that are called the ſixt paire or couple: which paire hath this ſingularity, that it beginneth in a great many litle branches, that preſently grow together, and make two great ones contained within one skinne. Now this being the property of a ſenſe (which requireth to haue many fibers in it, to the end that it may be eaſily and vigorouſly ſtrucken, by many partes of the obiect lighting vpon many partes of thoſe little fibers) it giueth vs to vnderſtand, that this ſixt couple hath a particular nature, conformable to the nature of an externe ſenſe; and that the Architect who placed it there, intended by the ſeuerall conduites of it, to giue notice vnto ſome part they goe vnto, of what paſſeth in the braine: and accordingly one branch of this nerue, reacheth to the hart; not only to the Pericardium, as Galen thought, but euen to the very ſubſtance of the hart it ſelfe, as later Anatomiſtes haue diſcouered: by which we plainely ſee how the motion

3. How the motions of the fantaſie, are deriued to the hart.

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which the ſenſes do make in the *Speculum*, may be deriued downe to the hart.

4. Of paine and pleaſure.

Now therefore lett vs conſider, what effects the motions ſo conueyed from the braine, will worke in the hart. Firſt remembring how all that moueth the hart, is eyther paine or pleaſure (though we do not vſe to call it paine, but griefe, when the euill of ſenſe moueth vs only by memory, and not by being actually in the ſenſe) and then calling to mind, how paine (as Naturaliſtes teach vs) conſiſteth in ſome diuiſion of a nerue, (which they call *Solutio continui:* and muſt be in a nerue; for that no ſolution can be the cauſe of paine, without ſenſe, nor ſenſe be without nerues; and therefore this ſolution muſt needes be in nerues, to haue it proue painefull,) we may conclude, that the effect which we call paine, is nothing elſe but a compreſſion: for although this ſolution of continuity may ſeeme to be a dilatation; yet in truth, it is a compreſſion, in the part where the euill is, which happeneth vnto it in the ſame manner as we shewed (when we ſpoke of the motion of reſtitution) it doth to ſtiffe bodies, that by violence are compreſſed and drawne into a leſſe capacious figure, then their nature affecteth, and returne into their owne ſtate as ſoone as the maſtering violence leaueth them at liberty.

Pleaſure therefore, muſt be contrary to this, and conſiſt in a moderate dilatation; for an immoderate one, would cauſe a compreſſion in ſome adherent partes; and there would become paine. And conformable to this, we experience, that generally they are hard thinges which breed paine vnto vs; and that theſe which breed pleaſure, are oyly and ſoft; as meates, and odours, which are ſweete to the taſte and ſmell; and ſoft ſubſtances, which are gratefull to the touch: the exceſſe of all which proueth offenſiue and painefull; ſo that from the extremity of pleaſure, one entereth preſently vpon the confines of paine.

Now then lett vs conſider, how the little ſimilitudes of bodies, which from without do come into the fantaſy, muſt of neceſſity worke there, according to their little power, effects proportionable to what they wrought firſt in the outward ſenſes, from whence, they were conueyed to the braine: for the ſenſes (that is the nerues) and the *Septum Lucidum*, hauing both of them their origine from the very ſubſtance of the braine, and differing only in degrees of purity and refinement, the ſame obiect muſt needes worke like effects in both, compreſſing or dilating them proportionably to one an other: which compreſſion or dilatation, is not paine or pleaſure, as it is in the outward ſenſe; but as it is reported to the hart: and that, being the ſeate of all paines or pleaſures wrought in other partes, and that (as it were) dyeth them into thoſe qualities, is not capable of feeling eyther it ſelfe: ſo that the ſtroakes of any little ſimilitudes vpon the fantaſy, do make only compreſſions or dilatations there, not paines or pleaſures.

5. Of Paſſion.

Now their bodies or ſimilitudes, if they be reuerberated from the fantaſy or *ſeptum Lucidum*, vpon the little rootes of the nerues of the ſixt couple, which goe to the hart, they muſt needes worke there a proportionable

proportionable impreſſion to what they wrought vpon the fanſy, eyther compreſſing or dilating it; and the hart being extremely paſſiue, by reaſon of its exceeding tenderneſſe and heate; can not chooſe but change its motion, at the leaſt in part, if not in whole: and this with relation to two cauſes: the one the diſpoſition of the hart it ſelfe; the other, the vehemency of the ſtroake.

This change of motion and different beating of the hart, is that which properly is called paſſion: and is euer accompanyed with pleaſure or with griefe, according to the nature of the impreſſion, that eyther contracteth or dilateth the hart and the ſpirits about it: and is diſcouered by the beating of the arteries and of the pulſe. Conformable wherevnto, Phyſitians do tell vs, that euery paſſion hath a diſtinct pulſe.

6. Of ſeuerall pulſes cauſed by paſſions.

Theſe pulſes are diuided in common, by aboundance, or by want of ſpirits: yet in both kinds, they may haue common differencies; for in aboundance, the pulſe may be quicke or ſlow, regular or irregular, equall or vnequall: and the like may happen in defect of ſpirits; according to the motions of the hart, which are their cauſes. Againe, the obiect by being preſent or abſent, neerer or further off, maketh the ſtroake greater or leſſer: and accordingly, varyeth the motion of the hart.

Lett vs then call to mind, how we haue formerly declared, that life conſiſteth in heate and humidity; and that theſe two ioyned together, do make a thing great: and we may conclude, that of neceſſity the motion which is moſt liuely, muſt haue a great, full, and large ſtroake: like the euē rolling waues of a wyde and ſmooth ſea; and not too quicke or ſmart, like the breaches of a narrow *Fretum*, agitated by tempeſtuous windes. From this, other motions may vary eyther by exceſſe, or by deficiency: the firſt maketh the ſtroake become ſmart, violent, and thicke: the other ſlackeneth it, and maketh it grow little, ſlow, weake, and thinne, or ſeldome.

And if we looke into the motions of our hart, we ſhall ſee theſe three differencies of them, follow three ſeuerall chiefe paſſions. The firſt, followeth the paſſion of ioy: the ſecond, the paſſion of anger: and the third the paſſion of griefe. Nor neede we looke any further into the cauſes of theſe ſeuerall motions: for we ſee that ioy and griefe, following the ſtroake of ſenſe, the one of them muſt conſiſt in an oyly dilatation: that is, the ſpirits about the hart, muſt be dilated by a gentle, large, great, and ſweete motion, in a moderation between velocity and ſlowneſſe: the other contrarywiſe, following the ſtroake of ſenſe in paine, as the firſt did in pleaſure, muſt contract the ſpirits; and conſequently make their motion or ſtroake become little, and deficient from all the properties we haue aboue ſett downe.

As for anger, the motion following that paſſion, is, when the aboundance of ſpirits in the hart is a little checked by the contrary ſtroake of ſenſe, but preſently ouercometh that oppoſition: and then, as we ſee a hindered water, or a man, that ſuddainely or forcibly breake

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through what withstood their motion, go on with a greater violence then they did, and as it were precipitately: so the hart, hauing ouercome the contraction, which the sense made in it, dilateth it selfe with a fury, and maketh its motion smart and vehement. Whence also it followeth, that the spirits grow hoater then they were: and accordingly, it is often seene, that in the scoulding of a woman, and in the irritation of a dogg, if euer now and then, one thwart them, and interpose a little opposition, their fury will be so sharpened and heightened, that the woman will be transported beyond all limits of reason, and the dogg will be made madde with nothing else done to him, but angring him at conuenient times: and some men likewise, haue by sleight oppositions, iterated speedily vpon them, before their spirits could relent their vehement motion (and therefore, must still encrease it) beene angred into feauers.

This passion of anger, seemeth almost to be solitary on the side of excesse beyond ioy: which is, as it were the standard and perfection of all passions; as light or whitenesse, is of all colours: but on the other side, of deficiency, there are seuerall middle passions, which participate more or lesse of ioy and griefe: as particularly those two famous ones, which gouerne mans life, *Hope* and *Feare*. Concerning which, Physitians tell vs, that the pulse or beating of feare, is quicke, hard, and vnequall: vnto which I conceiue we may safely adde, that it must also be small and feeble; the perfection of ioy, decreasing in it on one side, to witt, from greatnesse and largenesse; but not intirely; so that a kind of quickenesse supplyeth in part the other defect. Hope on the other side, is in such sort defectiue from ioy, that neuertheless it hath a kind of constancy, and moderate quantity, and regularity in its motion: and therefore is accounted to be the least hurtfull of all the passions, and that which most prolongeth mans life. And thus you see how those motions, which we call passions, are engendred in the hart, and what they are.

7. Of seuerall other effects caused naturally in the body by passiõs.

Lett vs then in the next place consider, what will follow in the rest of the body, out of these varieties of passions, once raysed in the hart and sent into the braine. It is euidẽt, that according to the nature and quality of these motions, the hart must needes in euery one of them, voyde out of it selfe into the arteries, a greater or lesser quantity of bloud, and that in diuers fashions: and the arteries which lye fittest to receiue these suddaine egestions of bloud, are those which goe into the braine: whose course being directly vpwardes, we can not doubt, but that it is the hoatest and subtilest part of the bloud, and the fullest of spirits, that flyeth that way. These spirits then running a lõg and perplexed iourney vp and downe in the braine, by various meanders and anfractuosities, are there mingled with the humide steame of the braine it selfe, and are therewith cooled; and do come at the last, to smoake at liberty in the hollow ventricles of the braine, by reeking out of the little arteriall branches, that do weaue the *plexus choroides*, or nette we spoke of ere while:

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while: and they being now growne heauy, do fall (by their naturall course) into that part or processe of the braine, which is called *medulla spinalis*, or the marrow of the backe bone: which being all beset by the nerues that runne through the body, it can not happen otherwise, but that these thickened and descending spirits, must eyther fall themselues into those nerues, or else presse into them other spirits which are before them, that without such new force to driue them violently forwardes, would haue slided downe more leisurely. Now, this motion being downewardes, and meeting with no obstacle till it arriue vnto its vtmost periode that way, the lowest nerues are those, which naturally do feele the communication of these spirits first.

But it is true, if the flowing tide of them be great and plentifull, all the other nerues will also be so suddainely filled, vpon the filling of the lowermost, that the succession of their swellings, will hardly be perceptible: as a suddaine and violent inundation of water, seemeth to rise on the sides of the channell, as it doth at the milldamme; though reason assureth vs it must beginne there, because there it is first stopped.

On the contrary side, if the spirits be few, they may be in such a proportion, as to fill only the lower nerues, and to cõmunicate little of thẽselues to any of the others. And this is the case in the passion of feare: which being stored with fewer spirits, thẽ any other passiõ that causeth a motiõ in the body, it moueth the legges most; and so carryeth the animal that is affrayd, with violence from the obiect that affrighteth him. Although in truth, it is a faint hope of escaping, mingled with feare, which begetteth this motion: for when feare is single, and at its height, it stoppeth all motion by contracting the spirits, and thence is called *stupor*; as well as griefe, for the same reason: and accordingly we see extreme cowardes in the extremity of their feare, haue not the courage to runne away, no more then to defend or helpe themselues by any other motions.

But if there be more aboundance of spirits; then the vpper partes are also moued, as well as the legges; whose motion contributeth to defense: but the braine it selfe, and the senses which are in the head, being the first in the course of this flood of spirits, that is sent from the hart to the head; it is impossible, but that some part of them, should be pressed into the nerues of those senses, and so will make the animal vigilant and attentiue to the cause of its feare or griefe.

But if the feare be so great, that it contracteth all the spirits, and quite hindereth their motion, (as in the case we touched aboue) then it leaueth also the nerues of the senses destitute of spirits; and so by too strong apprehension of a danger, the animall neyther seeth nor apprehendeth it: but as easily precipitateth it selfe into it, as it happeneth to auoyde it; being meerely gouerned by chance; and may peraduenture seeme valiant, through extremity of feare.

And thus you see in common, how all the naturall operations of the body, do follow by naturall consequence out of the passions of the

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mind: without needing to attribute discourse or reason, eyther to men or beastes to performe them. Although at the first sight, some of them may appeare vnto those that looke not into their principles and true causes, to flow from a source of intelligence: whereas it is euident by what wee haue layed open, they all proceed from the due ranging and ordering of quantitatiue partes, so or so proportioned by rarity and density. And there is no doubt, but who would follow this search deepely, might certainly retriue the reasons of all those externall motions, which wee see vse to accompany the seuerall passions in men and Beastes. But for our intent wee haue said enough, to shew by what kind of order and course of nature, they may be effected (without confining our selues ouer scrupulously to euery circumstance that we haue touched) and to giue a hinte, whereby others that will make this inquiry their taske, may compile an intire, and well grounded and intelligible doctrine of this matter.

Only we will adde one aduertissement more; which is, that these externall motions caused by passion, are of two kindes: for some of them are as it were the beginnings of the actions, which nature intendeth to haue follow out of the passions that cause them: but others are only bare signes of the passions that produce them, and are made by the cõnexion of partes vnnecessary for the maine action that is to follow out of the passion, with other partes that by the passion are necessarily moued: as for example, when an hungry mans mouth watereth at the sight of good meate; it is a kind of beginning of eating, or of preparation for eating: for when we eate, nature draweth a moysture into our mouth, to humectate our meate, and to conuey the tast of it into the nerues of the tongue, which are to make report of it vnto the braine: but when we laugh, the motion of our face aymeth at no further end, and followeth only by the connexion of those muscles, which draw the face in such a sort, vnto some inward partes, that are moued by the passion, out of which laughing proceedeth.

8. Of the diaphragma.

But we must not leaue this subiect without some mention of the diaphragma: into which the other branch of those nerues, that are called of the sixt coniugation, doth come: for the first branch we haue said goeth into the hart, and carryeth thither the obiects that come into the braine: and this, we shall find, carryeth backe to the braine the passion or motion, which by the obiect is raysed in the hart. Concerning this part of our body, you are to note, that it is a musculous membrane, which in the middle of it hath a sinnewy circle; wherevnto is fastened the case of the hart, called the Pericardium. This Diaphragma is very sensible, receiuing its vertue of feeling from the aboue mentioned branch of the sixt couple of nerues: and being of a trembling nature, is by our respiration kept in continuall motion: and flappeth vpon all occasions, as a drumme head would do, if it were slacke and moyst; or as a sayle would do, that were brought into the wind.

Out of

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Out of this description of it, it is obuious to conceiue, that all the changes of motion in the hart, must needes be expressed in the Diaphragma. For the hart beating vpon the Pericardium, and the Pericardium being ioyned to the Diaphragma; such iogges and vibrations must needes be imprinted and ecchoed there, as are formed in the hart: which from thence, can not choose but be carryed to the braine by the sixt couple of nerues. And thus it cometh about, that we feele and haue sensation of all the passions, that are moued in our hart. Which peraduenture is the reason, why the Greekes do call this part φρενες; and from it deriue the verbe φρονεῖν, that in latine signifyeth *Sapere*, with vs, to sauour or to like: for by this part of our body, we haue a liking of any obiect, or a motion of inclination towardes it: from whence σωφρονεῖν is deriued, by composition of φρονεῖν, with σαος: for a prudent man is he, that liketh, and is moued to compasse wholesome and good thinges. Which Etymology of the word, seemeth vnto me more naturall, then from the phrenesy, from whence some deriue it; becausse a great distemper or inflammation in the Diaphragma, often causeth that disease.

9. Concerning paine and pleasure caused by the memory of thinges past.

Now, becausse the obiect is cõueyed frõ the braine to the hart some part of its way, by the same passage, as the motion of the hart is reconueyed backe to the braine; it must of necessity follow, that who is more attẽtiue to outward sense, doth lesse consider or reflect vpõ his passion; and who is more attentiue to obserue, and be gouuerned by what passeth in his hart, is lesse wrought vpon by externall thinges. For if his fantasy draweth strongly vnto it, the emanations from outward agents vpon the senses, the streame of those emanations will descend so strongly from the ouerfilled fantasy into the hart, that it will hinder the ascent of any fewer and weaker spirits by the same pipe. But if the current do sett strongest vpwardes, from the hart by the Diaphragma to the braine, then it will so fill the pipe by which it ascendeth, that little of a weaker tyde, can make a contrary eddy water in the same channell.

And by this meanes, nature effecteth a second pleasure or paine in a liuing creature, which moueth it (oftentimes very powerfully) in absence of the primary obiect: as we may obserue, when thinking of any pleasing or displeasing action, we find about our hart a motion which enticeth vs to it, or auerteth vs from it: for as the first pleasure was occasioned by the stroake, which the obiect applyed to the outward sense, made vpon the fantasy, (which can iudge of nothing without being strucken by it) so the second pleasure springeth from the spirits moued in the hart, by messengers from the braine, which by the Diaphragma do rebound a stroake backe againe vpon the fantasy. And from hence it proceedeth, that memory delighteth or afflicteth vs; and that we think of past thinges with sweetenesse or with remorse: and thereby assuefaction is wrought in beastes, as farre as the appetitiue part doth contribute therevnto, to perfect what was begunne in their cognoscitiue part, by the ingression of corporeall speciesses into their

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fantasy, in order to the same effect, as we haue touched before.

10. How so small bodies as atomes are, can cause so great motions in the hart.

But now lett vs examine, how so small a quantity of a body, as cometh from an obiect into our sense, can be the cause of so great a motion about our hart. To which purpose we are to remember, that this motion is performed in the most subtile and thinne substance, that can be imagined: they are the vitall spirits, that do all this worke; which are so subtile, so agile, and so hoat, that they may in some sort be termed fire. Now if we reflect how violent fire is, we neede not wonder at the suddaine and great motion of these passions.

But we must further take notice, that they are not in the greatest excesse, but where the liuing creature hath beene long inured and exercised vnto them, eyther directly or indirectly: so that they arriue not to that pitch so much out of the power of the agent, as out of the preparation and disposition of the patient; as when cold water hath beene often heated by extinguishing red hoat irons in it, after some repetitions a few quenchinges will reduce it from cold to boyling, that at the first would scarce haue made it lukewarme: and accordingly we see a hart, that for a long time hath loued, and vehemently hath desired enioying, is transported in a high degree, at the least sight and renuance of stroakes from its beloued obiect; and is as much deiected, vpon any the least depriuation of it: for to such an obiect, the liuing creature is hurried away by a force much resembling the grauity or celerity of a dense body, that is sett on running downe a steepe hill; vnto which, the only taking away of a weake lett or the least stoppe, giueth a precipitate course; not out of the force of what is done to it, but out of the force which was formerly in the thing, though for the present it lay there vndiscouered: and so likewise in these cases, the obiect rather giueth the occasion of the violent motion, then the force or power to it.

11. How the vital spirits sent frō the braine, do runne to the intended part of the body without mistake.

These thinges being thus determined, some peraduenture may aske, how it cometh to passe, that the spirits which cause motion, being sent on their arrant by the braine, do alwayes hitt the right way, and light duely into those very sinnewes, which moue the liuing creature according as is requisite for its nature? Since all the passages are open, what is it that gouerneth them, so as they neuer mistake, and the animal is neuer driuen towardes harme, insteed of flying from it? Who is their guide in these obscure pathes? But it were to impute ignorance to the maker, to think that he framed all the passages alike, and so euery one of them, promiscuously apt to receiue into them, all sorts of spirits howsoeuer they be moued: and therefore, we may assure our selues, that since in these diuersities of occasions, there are likewise diuers kinds of motions from the hart; eyther there is proportionable vnto them, diuers kindes of passages fitt to receiue and entertaine the spirits, according to the condition they are in, so as the passages which are aiusted to one kind of spirits, will not admitt any of an other nature: or else, the first motions of liking or disliking in the hart, which (as we haue said) do cause a swelling or a

contraction

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contraction of it against this or that part; doth stoppe and hinder the the entrance of the spirits into some sinewes, and doth open others, and driueth the spirits into them: so as in the end, by a result of a chaine of swellinges and contractions of seuerall partes succesiuely one against an other, the due motions of prosecution or auersion are brought about.

As for example; an obiect that affecteth the hart with liking, by dilating the spirits about the hart, sendeth some into the optike nerues, and maketh the liuing creature turne his eye towardes it and keepe, it steady vpon what he desireth: as contrariwise, if he dislike and feare it, he naturally turneth his eye and head from it. Now, of this motion of the eye and head, may depend the running to the thing in one case, and the running from it in the other: for the turning of the necke one way, may open a passage for the spirits into those sinewes, which carry the rest of the body towardes the obiect: and the turning of it to the other side, may open other sinewes, which shall worke a contrary effect, and carry the animal from the obiect: and the mouing of those sinewes, which at the first do turne the necke, doth proceed from the quality and number of the spirits that ascend from the hart, and from the region of the hart from whence they are sent: according to the variety whereof, there are diuers sinewes fitted to receiue them.

To make vp which discourse, we may call to mind, what we haue said a litle aboue, concerning the motions caused in the externall partes of the body, by pasion mouing within: as when feare mingled with hope, giueth a motion to the legges, anger to the armes and handes, and all the rest of the body, as well as to the legges; and all of them, an attention in the outward senses; which neuertheless peruerteth euery one of their functions, if the pasion be in extremity. And then surely, we may satisfy our selues, that eyther this, or some way like it (which I leaue vnto the curious in Anatomy to settle with exactenesse; for it is enough for my intent, to shew in grosse how these operations may be done, without calling in some incomprehensible qualities to our ayde) is the course of nature in motions, where no other cause interueneth, besides the obiect working vpon the sense: which all the while it doth, it is the office of the eye of fantasy or of common sense, to lye euer open; still watching to obserue what warninges the outward senses do send vnto him; that accordingly he may direct and change, the motions of the hart and of the whole body.

12. How men are blinded by Passion.

But if the obiect do make violent impressions vpon the sense; and the hart, being then vehemently moued, do there vpon send aboūdance of spirits vp to the braine; this multitude of spirits thronging vpon the common sense, oppresseth it (as we haue already said) in such sort, that the notice which the sense giueth of particular circumstances, can not preuayle to any effect in the braine: and thus by the misguidance of the hart, the worke of nature is disordered: which when it happeneth, we

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expreſſe in short, by ſaying that paſſion blindeth the creature, in whom ſuch violent and diſorderly motions haue courſe; for paſſion is nothing elſe, but a motion of the bloud and ſpirits about the hart; and is the preparation or beginning of the animals working; as we haue aboue particularly diſplayed.

And thus you ſee in common, how the circuite is made from the obiect to the ſenſe; and from it by the common ſenſe and fantaſy, to the hart; and from the hart backe againe to the braine; which then ſetteth on worke thoſe organes or partes the animal is to make vſe of in that occaſion: and they eyther bring him to, or carry him from the obiect, that at the firſt cauſed all this motion, and in the end becometh the periode of it.

THE SIX AND THERTIETH CHAPTER.

Of ſome actions of beaſtes, that ſeeme to be formall actes of reaſon, as doubting, reſoluing, inuenting.

1. The order and connexion of the ſubſequent Chapters.

IN the laſt Chapter the foundations are layed, and the way is opened, for the diſcouering how all operations which proceed from nature and paſsion, are performed among liuing creatures: and therefore, I conceiue I haue thereby ſufficiently complyed with the obligation of my intention: which is but to expreſſe and shew in common, how all the actions of ſenſible bodies may be reduced to locall motion, and to materiall application of one body vnto an other, in a like manner (though in a different degree) as thoſe motions which we ſee in liuelieſt bodies. Yet becauſe among ſuch animals as paſſe for irrationall, there happen ſome operations of ſo admirable a ſtraine, as reſemble very much the higheſt effects which proceed from a man: I thinke it not amiſſe, to giue ſome further light, by extending my diſcourſe to ſome more particulars then hitherto I haue done; whereby the courſe and way how they are performed, may be more clearely and eaſily looked into: and the rather, becauſe I haue mette with ſome men, who eyther wanting patience to beſtow on thoughts of this kind ſo much time as is neceſſary for the due ſcanning of them; or elſe through a promptitude of nature, paſsing ſwiftly from the effect they looke vpon in groſſe, to the moſt obuious ſeeming cauſe; do ſuddainely and ſtrongly reſolue, that beaſtes vſe diſcourſe vpon occaſions, and are endewed with reaſon.

This I intend not to doe quite in particular, for that were to write the hiſtory of euery particular animal: but will content my ſelfe with touching the cauſes in common; yet in ſuch ſort, that the indifferent Reader may be ſatisfyed of a poſsibility, that theſe effects may proceed from materiall cauſes: and that I haue poynted out the way, to thoſe who

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are more curious, and haue the patience and leisure to obserue diligently what passeth among beastes, how they may trace these effects from steppe to steppe, vntill at length they discouer their true causes.

To beginne then; I conceiue we may reduce all those actions of beastes, which seeme admirable, and aboue the reach of an irrationall animal, vnto three or foure seuerall heades. The first may be of such, as seeme to be the very practise of reason, as doubting, resoluing, inuenting and the like. The next shall be of such, as by docility or practise beastes do oftentimes arriue vnto. In the third place, we will consider certaine continuate actions of a long tract of time, so orderly performed by them, as that discourse and rationall knowledge seeme clearely to shine through them. And lastly we will cast our eye vpon some others, which seeme to be euen aboue the reason that is in man himselfe, as the knowing of thinges which the sense neuer had impression of before, a prescience of future euents, prouidences, and the like.

2. From whence proceedeth the doubting of beasts.

As for the first: the doubting of beasts, and their long wauering sometimes betweene obiects that draw them seuerall wayes, and at the last their resoluing vpon some one of them, and their steady pursuance of that afterwardes; will not be matter of hard digestion to him, that shall haue well relished and meditated vpon the contents of the last Chapter: for it is euident, that if seuerall obiects of different natures do at the same time present themselues vnto a liuing creature, they must of necessity make diuers impressions in the hart of it, proportionable vnto the causes from whence they proceed: so that if one of them be a motion of hope, and the other be of feare; it can not choose but follow thence, that what one of them beginneth, the other will presently breake off: by which meanes it will come to passe, that in the beastes hart there must needes be such wauinges, as we may obserue in the sea, when at the beginning of a tide of flood, it meeteth with a banke that checketh the coming in of the waues, and for a while, beateth them backe as fast as they presse vpon it; they offer at getting ouer it, and by and by retire backe againe from the steepenesse of it, as though they were apprehensiue of some danger on the other side; and then againe attempt it a fresh: and thus continue labouring, one while one way, an other while an other; vntill at the length the flood encreasing, the water seemeth to grow bolder, and breaketh a maine ouer the banke, and then floweth on, till it meeteth with an other, that resisteth it, as the first did: and thus you see, how the sea can doubt and resolue, without any discoursing. In the like manner it fareth with the hart of a beast (whose motions do steere the rest of his body) when it beateth betwixt hope and feare, or between any other two contrary passions, without requiring any other principles from whence to deduce it, then those we haue already explicated.

3. Concerning the inuention of Foxes and other beasts.

But now to speake of their inuentions I must confesse, that among seuerall of them, there appeareth so much cunning in laying of their plots (which when they haue compassed, they seeme to grow careless

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and to vnbend their attention, as hauing obtained what with earneſtneſſe they deſired) that one might thinke they wrought by deſigne, and had a diſtinct view of an end; for the effecting of which, they vſed diſcourſe to chooſe the likelieſt meanes.

To this purpoſe the ſubtilities of the foxe are of moſt note. They ſay he vſeth to lye as if he were dead; thereby to make hennes and duckes come boldly to him. That in the night, whē his body is vnſeene, he will fixe his eyes vpon poultry, and ſo make them come downe to him from their rooſte. That to ridde himſelfe of the fleas that afflict him in the ſummer, he will ſinke his body by litle and litle into the water, while the fleas creepe vp to his head (to ſaue themſelues from drowning) and from thence to a bough he holdeth in his mouth; and will then ſwimme away, leauing them there. That to coſen the badger of his earth, he will piſſe in it; as knowing that the ranke ſmell of his vrine, will driue the other cleanelier beaſt to quitt it. That when doggs are cloſe vpon him, and catching at him, he will piſſe vpon his tayle, and by ſtriking that vp and downe, will endeauour (you may beleeue) to make their eyes ſmarte, and ſo retarde their purſuite, that he may eſcape from them.

And there are particular ſtories, that expreſſe yet more cunning then all theſe: as of a foxe, that being ſore hunted, hanged himſelfe by the teeth among dead vermine in a warren; vntill the doggs were paſſed by him, and had loſt him. Of an other, that in the like diſtreſſe, would take into his mouth a broome bush growing vpon a ſteepe cliffe on the ſide hand neere his denne (which had an other way to it, eaſy enough of acceſſe) and by helpe of that, would ſecurely caſt himſelfe into his hole; whiles the doggs that followed him haſtily, and were ignorant of the danger, would breake their neckes downe the rockes.

It is ſaid, that in Thracia, the country people ſo know whether the riuers that are frozen in the winter, will beare them or no, by marking whether the foxes venture boldely ouer them, or retire after they haue layed their eares to the yce, to liſten whether or no they can heare the noyſe of the water running vnder it: from whence you may imagine they collect, that if they heare the current of the ſtreame, the yce muſt needes be thinne; and conſequently dangerous to truſt their weight vnto it.

And to buſye my ſelfe no longer with their ſuttleties, I will conclude with a famous tale of one of theſe crafty animals; that hauing killed a gooſe on the other ſide of the riuer, and being deſirous to ſwimme ouer with it, to carry it to his denne, before he would attempt it (leaſt his prey might proue too heauy for him to ſwimme withall, and ſo he might looſe it) he firſt weighed the gooſe with a piece of wood, and then tryed to carry that ouer the riuer, whiles he left his gooſe behind in a ſafe place; which when he perceiued he was able to do with eaſe, he then came backe againe, and ventured ouer with his heauy birde.

They,

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They say it is the nature of the Iacatray to hide it selfe, and imitate the voyce of such beasts, as it vseth to prey vpon; which maketh them come to him, as to one of their owne fellowes; and then he seiseth vpon them and deuoureth them.

The Iaccall, that hath a subtile sent, hunteth after beasts; and in the chace, by his barking guideth the lyon, (whose nose is not so good) till they ouertake what they hunt; which peraduenture would be too strong for the Iaccall; but the lyon killeth the quarry, and hauing first fed himselfe, leaueth the Iaccall his share: and so between them both, by the ones dexterity, and by the others strength, they gett meate for nourishment of them both.

Like storyes are recorded of some fishes. And euery day we see the inuentions of beasts to saue themselues from catching: as hares, when they are hunted, seeke alwayes to confound the sent; sometimes by taking hedges, other whiles waters; sometimes running among sheepe and other beasts of stronger sents; sometimes making doubles, and treading the same path ouer and ouer; and sometimes leaping with great iumpes hither and thither, before they betake themselues to their rest; that so the cõtinuateneſſe of the sent may not lead doggs to their forme.

Now, to penetrate into the causes of these and of such like actions; we may remember, how we shewed in the last Chapter, that the beating of the hart worketh two thinges: the one is, that it turneth about the species, or litle corporeities (streaming from outward obiects) which remaine in the memory: the other is, that it is alwayes pressing on to some motion or other: out of which it happeneth, that when the ordinary wayes of getting victuals, or of escaping from enemies, do faile a creature whose constitution is actiue; it lighteth sometimes (though peraduenture very seldome) vpon doing something, out of which the desired effect followeth; as it can not choose but fall out now and then, although chance only do gouerne their actions: and when their action proueth successe full, it leaueth such an impression in the memory, that whensoeuer the like occasion occurreth, that animal will follow the same methode; for the same species do come together from the memory into the fantasy. But the many attẽpts that miscarry, and the ineffectuall motions which straightes do cast beasts vpon, are neuer obserued, nor are there any stories recorded of them: no more then in the temple of Neptune, were kept vpon the registres, the relations of those vnfortunate wretches, who making vowes vnto that god in their distresse, were neuertheleſſe drowned.

4. Of foxes that catch hennes by lying vnder their roost, and by gazing vpon them.

Thus peraduenture, when the foxe seeth his labour in chaceing the hennes, to be to no purpose; and that by his pursuite of them, he driueth them further out of his reach; he layeth himselfe downe to rest, with a watchfull eye, and perceiuing those silly animals to grow bolder and bolder, by their not seing him stirre, he continueth his lying still, vntill some one of them cometh within his reach, and then on a suddaine, he

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ſpringeth vp and catcheth her: or peraduenture ſome poultry might haue ſtrayed within his reach whiles he was aſleepe, and haue then wakened him with ſome noiſe they made; and ſo he happen to ſeiſe vpon one of them, without eyther deſigne or paines taking before hand: by ſuch degrees he might chance to catch one the firſt time: and they being ſettled in his memory, together with the effect; it happened that an other time when hunger preſſed him, and ſent vp to his braine like ſpirits vnto thoſe which aſcended thither whiles he lay watching the hennes; theſe ſpirits brought the other from his memory into his fantaſy (in ſuch ſort as we haue shewed in the laſt Chapter) and ſo droue him to the ſame courſe, vntill by frequent repetitions, it became ordinary and familiar with him: and then they that looke only vpon the performance of the artifice, are apt to inferre diſcourſe and a deſigne of reaſon, out of the orderly conduct of it.

But how can we conceiue the foxe hath iudgement to know when the henne is come within his leape, and accordingly offereth not att her till then; vnleſſe we reſort to ſome other principle, then what is yet declared? The anſwere vnto this obiection I thinke will not be hard to find; for if the motion, which the preſence of the obiect maketh in the hart, be proportioned out by nature (as there is no doubt but it is) it will not be ſo great and powerfull, as to make the foxe leape att it, vntill it be arriued ſo neere him, that by his nimbleneſſe he can reach it; and ſo without any ayme, further then by the meere fluxe of his paſſion conueniently rayſed, he doth the feate: but if his paſſion be too violent, it maketh him miſſe his ayme; as we may frequently obſerue both in men and beaſts: and particularly, when feare preſſeth eyther of them to leape ouer a ditch, which being too broad, he lighteth in the middeſt of it.

The ſame watchfullneſſe and deſire to haue the poulen, that ſitt vpon a tree out of his reach, maketh him fixe his eyes vpon them, when they are att rooſte: and att length, eyther the brightneſſe and ſparkling of them, dazeleth the birdes, and maketh them come downe to them, (as flyes do in the night about the flame of a candle; or as fiſhes do to a light in a boates head;) or elſe they are affraid; and their feare encreaſing, their ſpirits returne to the hart, which thereby is oppreſſed, and their outward partes are bereaued of ſtrength and motion; from whence it followeth neceſſarily, that their footing looſeth their hold faſt, and they tumble downe halfe dead with feare; which happeneth alſo frequently to catts, when they looke wiſtly vpon litle birdes that ſitt quietly. Or peraduenture, their feare maketh them giddy; as when ſome man looking downe a precipice from a dangerous ſtanding, he falleth by the turning of his braine, though nothing be behind him to thruſt him forewardes. Or it may be, ſome ſteame cometh from the foxe, which draweth ſuch creatures to him; as it is reported that a great and very poyſonous toade will do a weaſell, who will runne about the toade

a great

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a great while, and ſtill make his circle leſſer and leſſer, till at length he perisheth in the center, where his foe ſitteth ſtill, and draweth him to him: which he doth in ſuch ſort, as animated Mercury will draw leafe gold duely prepared, or as the loadeſtone attracteth iron: and yet it is apparent, the weaſell cometh not with his good will; but that there are ſome powerfull chaines, ſteaming from the body of the toade, which plucke him thither againſt his liking; for by his motions and running, he will expreſſe the greateſt feare that can be.

5. From whence proceedeth the foxes inuentiõ to ridde himſelfe of fleas.

The methode which foxes do practiſe, to ridde themſelues of their fleas (if it be true) is obuious enough for them to fall vpon; for in ſummer, their fleas together with their thicke furred coate, can not chooſe but cauſe an exceeding great itching and heate in their bodies; which will readily inuite them to go into the water to coole themſelues; as the marchantes at the Iſles of Zante and of Cephalonia told me (when I was there) it was the cuſtome of our English doggs (who were habituated vnto a colder clyme) to runne into the ſea in the heate of ſummer, and lye there moſt part of the day, with only their noſes out of the water, that they might draw breath, and would ſleepe there with their heads layed vpon ſome ſtone, which rayſed them vp, whiles their bodies were couered with the ſea: and thoſe doggs which did not thus, would in one ſummer vſually be killed with heate and fleas.

Now when the foxe feeleth the eaſe that the cooleneſſe of the water affordeth that part of him which ſitteth in it, he goeth further and further; yet would not putt himſelfe to ſwimme, which is a labour, and would heate him, and therefore he auoydeth it; ſo that whiles he thus cooleth himſelfe in ſome shady place (for it is naturall vnto him, in ſuch an occaſion, to reſort vnto the coole shade, rather then to lye in the ſunne) and in ſuch there being for the moſt part ſome boughes hanging ouer the water, it happeneth naturally enough, that he taketh ſome of the loweſt in his mouth, to ſupport him, and ſaue him the labour of ſwimming, whiles he lyeth at his eaſe, ſoaking and cooling himſelfe in the riuer. By which meanes it cometh to paſſe, that the fleas finding no part of him free from water, do creepe vp to the bough to reſcue themſelues from drowning: and ſo, when he is cooled enough, he goeth away and leaueth them there. In all which finding a benefitt and ſatisfaction, whenſoeuer the like occaſion bringeth thoſe ſpecieſes, from his memory into his fantaſy, he betaketh himſelfe to the ſame courſe, and therein finding his remedy, at length it groweth familiar to him.

In the like manner, Thales his mule, that was heauily loaden with ſalt, happening to ſtumble, and to fall in a riuer she was going ouer, the ſalt melted by the water ſoaking into the ſackes, and ſo she was eaſed of her burthen; which ſucceſſe made her, whenſoeuer she came to a riuer, and was troubled with her loading, she would lye downe in the water; and could not be reclaymed from it, till they charged ſackes of wooll vpon her backe, which growing heauier by their imbibing of water, weaned her from her former crafty habit. By

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which it is apparent, that it was memory and not iudgement, which made her for a while behaue her selfe so subtlely.

6. An explication of two other inuentions of foxes.

For the foxes driuing the badger from his earth, you will not thinke it needefull to allow him a forecast and designe in pissing in it: but as it is naturall for him, to rest in a place that he meeteth with fitt for that purpose; so is it for him to pisse in it, if the liste take him whiles he is there; which in all likelyhood it will, if he stay any time there, and giue a relaxation to all his partes by sleepe.

And when he pisseth in his taile, and shaketh it in the dogges eyes, it is euident that feare, not craft causeth this effect; for it auayleth him litle, and therefore is not likely to proceed frō iudgement. And of the other, it is a naturall effect in all beasts (when it is violent) to contract their tailes betweene their legges, and to make their vrine come from them, (by compressing the spirits in their hart, which should support their outward partes, and strengthen their splincter muscle) which their being snapped at and seised vpon by the dogges, shaketh from their bushy tailes (fitt to retayne it) and then lighting in the dogges eyes, the acrimony of it hurteth them, and maketh them shutt their liddes.

The story (if it be true) of the foxe, that to saue himselfe from the dogges that he heard following him in full crye, did hang by his teeth among dead vermine in a warren, is a very strange one I confesse: but it is conceiuable, how feare and wearinesse might cause him to seeke a shelter to hide himselfe: and in so plaine a tract of ground as warrens vse to be in, without any bush or hill to haue recourse vnto for reliefe, there appearing nothing but a gallowes hanged full of vermine; his fantasy might be moued (he being able to runne no further) to thrust himselfe among those dead bodies, that he saw rested quietly: and hauing no way to mingle himselfe with them, but hanging by his teeth; he might continue in that posture, till the doggs not suspecting him in the ayre, might runne vnder him, and ouershoote the sent: which whiles they cast about to recouer, by running to beate the next wood or shelter in view (as is there custome in losses of their chace; vnto which they are brought by their masters hunting them in that methode at the first) the wyly animal stealeth an other way, and recouereth himselfe.

7. Concerning Mountagues argument to proue that dogges make syllogismes.

This ouerrunning of the sent by dogges in the earnestnesse of their chace, putteth me in mind of Montagues argument, out of which he will inferre, that dogges vse discourse, and do make syllogismes in their hunting: for (sayth he) when they haue followed their chace downe a lane, that at length diuideth it selfe into three others; they will carefully smell at the first and at the second, and not finding that it hath gone in eyther of those, they boldly runne vpon the third, without euer laying their noses to the ground; as being assured by their discourse and reason, that since it went not in the two first, and there being but one remayning, it must of necessity haue gone there.

But this needeth no other cause, then that their eagernesse of hunting hauing

hauing made them ouershoote the sent, (which for a while remayneth in their noses, after they are parted from the obiect that caused it) they cast backe againe (as they are accustomed to be made to do in like occasions by the hunters that trayne them vp) and with their noses they try the ground all the way they goe; till coming neere where the chace went indeede, the sent striketh their noses (that by this time are growne empty of it) before they come at the place: and then they runne amaine in pursuite of it, with their heads held vp, (which is their conuenientest posture for running) and all the way, the sent filleth them at that distance without their needing to smell vpon the earth, to fetch it from thence.

8. A declaration how some tricks are performed by foxes, which seeme to argue discourse.

That foxe which vsed to cast himselfe by the aduantage of a bough into his denne, was so closely pursued by the doggs the first time he ventured vpon this feate, that he had not time to goe into his earth (his ordinary retreate, when he is neere it) by the easy and accessible way; but on the one side, to gett thither being strong in his fantasy, and on the other side, the precipice which he had oftē seene, coming likewise thither from his memory; these two concurring could not choose but make him goe warily thither: and in so dangerous a leape, it is naturall for him, to helpe himselfe by any thing in the way that can aduantage him: which happening to be by catching in his mouth a bough that hung ouer his denne, (the only suddaine meanes he hath to take hold of any thing) and from thence taking as it were a new rise for a second leape, he findeth himselfe in security: whiles the doggs vnacquainted with the place, runne violently on, as in the rest of their chace: and so are vpon the brimme of the precipice, before they perceiue it; and then it is too late for them to stoppe their course: and consequently, they breake their neckes. Which mischiefe to them the foxe needeth not haue in his designe, and accordingly tolle them that way; but chance begetting this deliurance of him at the first, when he was so hard pressed, his memory teacheth him to follow the same course, whensoeuer the like occasion occurreth.

But how many foxes doe there perish in attemps, which if they had succeeded, would haue beene accounted by slight iudgers, to be notable subtilities; but miscarrying are esteemed tumultuary motions without designe, caused by that animals fantasy and spirits, when he is in extremity? I remember how vpon a time, when I was hunting one, he being hard sett, and but litle before the doggs and the hunters, caught in his mouth the bough of a croked ashetree he runne vp a pretty way; which being in a hedge, he thereby hung downe a long the side of the hedge, and when we strucke him ouer the ribbes with our poles, he would not quitte his hold, (so strongly the feare of the doggs wrought in his fantasy) till greater blowes knocked him on the head. Which sheweth euidently that this action, was the effect of chance pressing his fantasy to do something; and not any reason or discourse prouiding for his safety: as we haue already said vpon occasion of the others hanging among the dead vermine in the warren.

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Thoſe in Thracia, that will not goe ouer a frozen riuer, when the yce is too thinne to beare them, are by their memory, not by their iudgment taught to retire; for at other times they haue beene wetted, when they haue hard the noiſe of the ſtreame running vnder the yce: or the very running of the water, calleth the ſpecieſes of ſwimming out from their memory, along with it into their fantaſy (neyther of which is pleaſant to them in the winter) and ſo diſliking the noiſe for the other effects ſake, that vſed to accompany it, they auoyde that which begetteth it, and ſo retire from the riuer. And the reaſon of their liſtening to the noiſe, proceedeth from the ſpirits, that their paſſion vpon apprehenſion of a danger preſſeth into the nerues of their ſenſes, as well as into the other nerues of their braine; which accordingly maketh them ſo vigilant, and attentiue then to outward obiects and motions.

9. Of the Iaccatrays inuention in calling beaſts to himſelfe.

That the Iaccatray or Hyæna, when he is hungry, should haue his fantaſy call out from his memory, the images of thoſe beaſts, which vſe to ſerue him in that occaſion, is the ordinary courſe of nature: and that together with thoſe images, there should likewiſe come along the actions and ſoundes which vſed to accompany them, and are lodged together with them in the memory, is alſo naturall; then, as litle ſtrange it is, that by his owne voice he should imitate thoſe ſoundes, which at that time do ſo powerfully poſſeſſe his imagination: and hauing a great docility in thoſe organes which forme the voice, like a parrat he repreſenteth them ſo liuely, that the deceiued beaſts flocke to him, and ſo are caught by him: which at the firſt happeneth by chance, but afterwardes by memory, and groweth familiar to him.

10. Of the Iaccalls deſigne in ſeruing the lyon.

Nor can we imagine, that the Iaccall hath a deſigne of ſeruing the lyon; but his nature being (like a dogg) to barke when he feeleth the ſent hoat (which he purſueth for his owne ſake) the lyon that dwelleth in the ſame woods with him, meeteth with the noiſe, and followeth it; and peraduenture would kill the Iaccal himſelfe, as well as what he hunteth, if he could ouertake him: but he being too nimble for the lyon, keepeth out of his reach; till hauing wearied the beaſt he chaceth, the lyon that followeth by the crye, cometh in when he is at abbay, and ſoone teareth in pieces what the other had not ſtrength enough ſo ſuddainely to maſter, and feedeth himſelfe vpon the quarry till he be full. All this while the Iaccall dareth not come neere the lyon, but ſtandeth at a diſtance with feare wayting till he haue done, and then after he is gone away, he taketh his turne to feede vpon what his ſurly maſter hath left.

11. Of ſeuerall inuentions of fiſhes.

The like reaſons it is probable we might find out among thoſe fiſhes that ſerue one an other, if we had the conueniency of obſeruing particularly how they behaue themſelues; as when the Whale hath ſeruice from his little guide (if the report be true; which is a neceſſary circumſtance to be inſerted in euery ſuch tale) and others of the like ſtraine.

The ſuttlety of the Torpedo (who hideth himſelfe in the mudde to benumme

benumme fishes, that may afterwards ſerue him to feede vpon) will not require to haue its origine from reaſon, and be done by deſigne; when you shall conſider it is naturall for ſuch cold creatures to emmudde themſelues: and then the fishes that ſwimme within the reach of his benumming faculty, will be ſtayd and frozen there: which becauſe they ſee him not, they apprehend not, till it be too late for them to auoyde it: and then, when the Torpedo cometh out, he feedeth vpon what he findeth lying ready in his way.

And in like manner, the ſcuttle fish, when he is in ſtraights of being taken by the fisherman, caſteth out a blackeneſſe that is within him, and ſo making the water become like inke, he oftentimes eſcapeth their handes in the darkened Element: which ariſeth from no diſcourſe of his, but feare maketh him voyde this liquor that is in him (as it made the foxe voyde his vrine) and in conſequence thereunto, the effect followeth.

Laſtly, when hares do vſe thoſe meanes we haue mentioned to confound the ſent, and to ſaue themſelues from the doggs that hunt them, we may obſerue, that they take therein the readieſt wayes, and the moſt obuious vnto ſenſe, to auoyde the euill they flye from. For what can be more direct to that effect, then to hide themſelues in hedge bottomes, or in woods? Or to ſwimme ouer a riuer, when that is the moſt immediate way to runne from the dogges? And when they are in a plaine, where there is no other shelter but flockes of sheepe or heardes of deere, what can be more naturall, then for them to hide themſelues amõg them, and runne a long with them, till the crye of the approaching houndes fright them away, whiles thoſe tamer beaſts abyde it neerer? 12. A diſcouery of diuers thinges done by hares, which ſeeme to argue diſcourſe.

Their doublings backward and foreward, may proceede from their feare, that diuerteth them ſtill from the way they are in at preſent, till the doggs coming neere, do putt the hare out of thoſe wauerings, and do make her runne ſtraight away: for they neuer double but when they are a great way before the doggs, and do not heare them. Or elſe it may be, that not hearing or ſeeing the doggs, their feare may be almoſt paſſed; and then the agitation which their ſpirits are in, gouuerneth the motions of their bodie, and will not lett them reſt vntill they be more appeaſed, (as you ſee weary people, that at their firſt ceaſing from running, can not ſitt ſtill: the like of which happeneth alſo frequently in the motions of ioy or of anger) and ſo it maketh them walke backwards and forewardes, in a pace proportionate to the agitation of the ſpirits within: and ſometimes thoſe moued ſpirits do make them bound and leape too and fro (like the loafe with quickeſiluer, we haue heretofore ſpoken of) as they iſſue from the hart by pulſes and ſtroakes; which happeneth when they beginne to ſettle towardes reſt. Or elſe peraduẽture their forme is ſo framed, that if they ſhould gett into it otherwiſe then by a iumpe, they would diſorder ſome part of it, and ſo be vnfenced and

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acold, or otherwise at vnease during their repose: and therefore their iumping too and froe, before they leape plump in, is to take their ayme; not much vnlike to doggs, turning about seuerall times before they lye downe: for harefinders (who vse to watch them) say they will do thus, though they be not pursued. And thus these actions which are imputed to craft, thereby to confound the doggs, or to wisedome, to walke themselues vntill they be growne into a fitting temper to sitt still; may all of them be reduced to those materiall and corporeall causes, which make them do their other ordinary motions, wherein we find no difficulty.

13. Of a foxe reported to haue weighed a goose, before he would venture with it ouer a riuer; and of fabulous stories in common.

If that of the foxes weighing his goose, before he would venture to carry it ouer the riuer, were plainely true as it is sett downe; I auowe I should be hard sett to find the principles from whence that discretion in him proceeded: but I conceiue this tale may be paired with that, which telleth vs of an other foxe who hauing his prey taken from him by an eagle, brought the next day a new prize into the same place, hauing first rolled it in the fire, so that some burning coales stucke vpon it; which the eagle coming againe and snatching from him, carried to her nest, which was thereby sett on fire; and the yong ones falling downe, became the foxes share, insteede of what their damme had robbed him of. Such stories so quaintly contriued, are fitter for a morall then for a naturall Philosopher: Æsope may entertaine himselfe and his disciples with them; whiles all the reflection I shall make vpon them, is, that when I heare any such finely ordered tales, I can not doubt but they are well amended in the relation, by those that tell them: it being the inclination and custome of most men, (partly through a desire of hauing strange thinges come from them; and partly out of a care that what they say may appeare like truth, and so be the easilier beleeued) to adde circumstances beyond the truth of the matter: which encreasing at euery new mans relation of the same accident (for this humour raigneth very generally) at the length, so hansome, and yet so strange a tale is composed; that the first authour or teller of it, wondereth at it as well as others, and can not discerne that his story begott this latter.

Therefore, when one of these fine tales is proposed to speculate vpon, and that I haue no light to guide me in determining what part of them to allow, and what to reiect; I thinke it better to expect an authentike record of it, then be too hasty at guesses: leauing such as pretend ability in reading of riddles, to descant of the wayes how such actions may be effected: but for others, that haue a semblance of truth, or do happen ordinarily, be they at the first sight neuer so like the operatiõs of reason, I doubt not but that the causes of them, may be reduced to the principles we haue already established; and the wayes of performing them, may be pitched vpon by such discourses about them, as we haue made about those examples we haue aboue produced. Especially if the actions themselues, were obserued by one that could iudge of them, and were reported with a desire of expressing the truth nakedly as in it selfe it lyeth;

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lyeth; for diuers times it happeneth, that men saying nothing but truth, do expresse it in such a manner, and with such termes, that the ignorant hearer conceiueth the thing quite an other way, then indeed it is, meerely for the too emphaticall expression: especially if the relatour himselfe misseth in conceiuing the true causes of what he reporteth, and so expresseth it proportionable to those which he apprehendeth.

To conclude then this first branch, we see how the doubting, the resoluing, the aymings, the inuenting, and the like, which we experience in beasts, may by the vestigies we haue traced out, be followed vnto their roote, as farre as the diuision of rarity and density; without needing to repaire vnto any higher principle, sauing the wisedome of the orderer and Architect of nature, in so admirably disposing and mingling these materiall, grosse, and lifelesse bodies, that strange effects and incomprehensible vnto them, who will not looke into their seuerall ioyntes, may follow out of them, for the good of the creature in whose behalfe they are so ordered.

14. Of the seuerall cryings and tones of beasts: with a refutation of those authours who maintaine thē to haue compleat lāguages.

But before we goe to the next poynt, we can not forbeare mentioning their vanity as well as ignorance, who to purchase the estimation of deeper knowers of nature, would haue it beleeued, that beasts haue compleate languages as men haue to discourse with one an other in; which they vaunted they had the intelligence of. It is true, that in vs speaking or talking is an operation of reason, not because it is in reason; but because it is the worke of reason, by an other instrument; and is no where to be found without reason: which those irrationall Philosophers, that pretended to vnderstand the language of beastes, allowed them, as well as the ability of talking to one an other: but it was because they had more pride then knowledge. Of which ranke one of the chiefe was Apollonius, surnamed from Thyana; for if he had knowne how to looke into the nature of beasts, he would haue perceiued the reason of the diuers voyces which the same beast in diuers occasions formeth.

This is euident, that an animals lunges and chest, lying so neere as they doe vnto his hart; and all voyce being made by the breathes coming out of his mouth, and through his windpipe; it must necessarily follow, that by the diuers ordering of these instruments, his voyce will become diuers; and these instruments will be diuersly ordered in him, according to the diuers motions of his hart: that is, by diuers passions in him (for so we may obserue in our selues, that our breath is much changed by our being in passion;) and consequently, as a beast is agitated by various passions, he must needes vtter variety of voyces; which cā not choose, but make diuers impressiōs in other beasts, that haue commerce with him; whether they be of the same kind as he is, or of a different: and so we see, that if a dogg setteth vpon a hogg, the bitten hogges crye maketh an impressiō in the other hogges, to come to their fellowes reskew, and in other dogges to runne after the crying hogg: in like manner anger in a dogge maketh snarling or barking, paine, whining;

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desire, an other kind of barking; and his ioy of seeing a person that he vseth to receiue good by, will breake out in an other kind of whining. So in a henne, her diuers passions worke diuers kindes of clocking; as when she seeth a kite, she hath one voice; when she meeteth with meate, an other; when she desireth to gather her chickins vnder her winges, a third: and so, vpon diuers occasions, a diuers sound; according to the diuers ordering of her vocall instruments, by the passion which presseth her hart. So that who would looke curiously into the motions of the dispositions of a beastes vocal instruments, and into the motions of the spirits about his hart (which motion we haue shewed is passion) would be able to giue account, why euery voyce of that beast was such a one, and what motion about the hart it were that caused it.

And as much may be obserued in men, who in paines and griefes, and other passions, do vse to breake out into those voyces, which we call interiections, and which signifyeth nothing in the vnderstanding of them that forme them, but to the hearer are signes of the passion from whence they proceed: which if a man do heedefully marke in himselfe, he will perceiue, that they are nothing else, but the suddaine eruptions of a great deale of breath together, caused by some compression made within him, by the paine he is in. Which is the reason that the striuing against groanings in certaine occasions, doth sicke persons much harme; for it disordereth the naturall motions of some principall partes within him, that are already too much agitated; and the countermotion by which they are checked, putteth them further into a more violent agitation. In the obseruation of these naturall eruptions of mens breath, caused by Passion, our fore fathers of old were so industrious, as to transferre the imitation of nature in this particular into Musike, so that their kindes of musike, were distinguished according to the diuision of mens passions; and by similitude would raise them in the hearers.

Out of this discourse also reason may be giuen, why birdes are more musicall then other creatures; to witt, because they are of a hoater complexion; and therefore, to their biggenesse, do require more breath and ayre to coole them; and consequently do make more noise, and more variety of it. Likewise, among beasts, doggs are the most vocall of any that conuerse with vs; who by their ready anger appeare to be the hoatest. Among men, those that are merry, or soone become heated with a litle wine, are giuen to talking and singing: and so are children, and women likewise; not so much through aboundance of heate, as because their heate doth easily vent.

And thus it is euident, that there is no true language among beastes: their voices not being tokens of diuers thinges or conceptions, but meerely the effects of diuers breathings, caused by diuers passions. Wherefore, since both breathing and passion, are easily reduced to the common principles of rarity and density; wee neede not trouble our selues any further, to seeke into the origine of this vocall faculty of beastes.

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THE SEVEN AND THERTIETH CHAPTER.

Of the docility of some irrationall animals; and of certaine continuate actions of a long tract of time so orderly performed by them, that they seeme to argue knowledge in them.

AS for docility, (which is our second head) Apes and Elephantes are most famed. Though peraduenture, the cunning and obedience of our hawkes and doggs, is no whitt inferiour to what is reported of them; and would be as much admired, were it not so common. I haue by sundry persons who haue seene him, beene told of a baboone, that would play certaine lessons vpon a guitarre. The indian histories make mention of Apes, that will goe to the tauerne and fetch wine for their Masters; as Lipsius his dogg would bring his Master as much meate from the market, as he carried money to his butcher to pay for. Of Elephants likewise, strange thinges are told: but because we can not easily iudge how to vnderstand reportes, whereof we haue not seene the experience; nor how farre to belieue them, I intend not to insist vpon the examining of them; for by looking into the nature and art of our houndes that follow a suite of bloud, or that draw dry foote; and of our hawkes, especially of the decoy duckes and Cormorants; a scantling may be giuen at all the rest. And although these thinges told at randome, may iustly seeme very admirable to any man the first time he heareth of them, yet to him that vnderstandeth how they are taught, there is no one passage but will appeare plaine enough.

1. How hawkes and other creatures are taught to doe what they are brought vp to.

The first degree is to tame the hawke by watching her from sleepe, and to acquaint her with the man, by continually carrying her vpon his fist, and vsing her to take her meate quietly, as she sitteth vpon his hand. Then he maketh her hoppe a litle way to it in a paire of cranes; and after a while, kill a seeled pigeon; from which he taketh her when she is growne steady in her lesson so farre, and feedeth her vp with other meate: and thus in time he bringeth her to fly at what he will haue her, and to be content with a small reward, leauing her quarry to her Master; so that a spectatour, who vnderstandeth not the mystery, nor euer saw hawking before, may well admire to see a bird so dutifully and exactly obey a mans command: and may conceiue she hath a reasonable soule, whereby to vnderstand him, and discourse of the meanes to bring his purpose to effect. Whereas indeed all this is no more, then to make her do for you and when you please, the same which she doth by nature to feede her selfe.

The cunning of doggs is begotten in the same way. Coyduckes are beaten and whipped to what they are taught, like setting doggs. Cormorantes haue their throates tyed, that they may not swallow the

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fish they catch, but be cõstrained to bring it to the man that employeth them; so that looking along steppe by steppe, you shall meete with nothing but what is plaine, and easy to be taught, and to be performed by sense and memory; without needing to attribute any discourse or reasoning vnto beastes.

Apes are likewise taught as dogges may be, to carry thinges to a certaine house; where receiuing what is giuen them, they returne home with it: and you may be confident, this seruiceableness of the Ape, grew out of his being carried first to the tauerne by the maide or boy, who there gaue him somewhat that pleased him; and then being made to carry the pott along by the boy; and afterwardes being made to carry money in one hand, and the pott in an other; whereof some drawer discharged him of the one, and filled the other, and withall gaue him a reward; which also was repeated to him at his returne home with his full pott: till at the last, when he was sufficiently vsed to this exercise, he would of himselfe goe straight thither, as soone as he was harnessed in such sort as he vsed to be for this seruice. Which appeareth to be assuefaction and custome, not iudgement, by his receiuing indifferently whatsoeuer is put into his pott.

And by the tale of Lipsius his dogg; from whom other lesse doggs, snatching as he trotted along, part of what hung out of his basket (which he carried in his mouth) he sett it downe to werry one of them; whiles in the meane time, the others fedde at liberty and at ease vpon the meate that lay there vnguarded; till he coming backe to it, droue them away, and himselfe made an end of eating it vp. Whereby we may conceiue, that the species of carrying his basket to his Master (which custome had settled in his memory) was disordered, and thrust out of his fantasy, by a stronger of fighting for his meate with the other curres: after which it followed naturally in his fantasy, to eate what he had fought for. And that sending then spirits into his nerues, agreeable to the nature of it, and gouerning the partes depending of the braine, a motion and action ensewed, which was sutable to the obiect in the fantasy; and this could be none other, but of eating what the fantasy found conformable vnto its nature.

2. Of the Baboone that played on a guitarre.

The baboone we haue mentioned, might be taught some lessons made on purpose with very few stoppes, and vpon an instrument whereon all the stringes may be strucken with one blow, and but one frette to be vsed at a time, and that frette to be stopped with one finger: of which, much labour and time might beget a habit in him: and then, imitation of the sound, might make him play in due measure. And if we will marke it in our selues, we shall see, that although in the first learning of a lesson vpon the lute, we employ our reason and discourse about it; yet when we haue it very perfect, our fingers (guided by a slight fantasy) do fall by custome, without any reflexion at all, to play it as well as if we thought neuer so carefully vpõ it. And there is no comparison, betweene the difficulty of a guitarre and of a lute.

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I haue beene told, that at the Duke of Florence his marriage, there was a dance of horſes, in which they kept exact time of muſike. The meanes vſed for bringing them to it, is ſaid to haue beene, by tying and hampering their legges in ſuch a ſort, that they could lift them vp but in a determinate way: and then ſetting them vpon a pauement, that was heated vnderneath ſo hott, as they could not endure to ſtand ſtill, whiles ſuch muſicall ayres were played to them, as fitted their motions. All which being often repeated, the horſes tooke a habitt, that in hearing thoſe ayres, they would lift vp their legges in that fashion; and ſo danced to the tune they had beene taught.

3. Of the teaching of Elephãtes and other beaſts to doe diuers tricks.

Of the Elephantes, it is ſaid that they may be taught to write; and that purely vpon wordes and commanding them, they will do what they are bidden; and that they are able to keepe account, and will leaue working at a preciſe number of reuolutions of the ſame action, which meaſureth out their taske vnto them. All which (as I ſaid before) if it were plainely and litterally true, would require very great conſideration: but becauſe the teachers of beaſtes, haue certaine ſecrets in their art, which ſtanders by do not reach vnto; we are not able (vpon ſuch ſcanty relations as we haue of them) to make ſufficient iudgement how ſuch thinges are done; vnleſſe we had the managing of thoſe creatures, whereby to try them in ſeuerall occaſions, and to obſerue what cauſe produceth euery operation they doe; and by what ſteppes they attayne vnto their inſtructions and ſeruiceableneſſe.

It is true, the vncontrolled reports of them, oblige vs to beleeue ſome extraordinary matter of their docility, and of ſtrange thinges done by them: but withall, the example of other taught beaſtes among vs, and of the ſtrange iudgements that are made of them by perſons, who do not penetrate into their cauſes, may inſtruct vs how eaſy it is to miſtake the matter; and aſſure vs, that the relations which are made vs, do not alwayes punctually agree with the truth of what paſſed. He that ſhould tell an Indian, what feates Bankes his horſe would do; how he would reſtore a gloue to the due owner, after his maſter had whiſpered that mans name in his eare; how he would tell the iuſt number of pence in any piece of ſiluer coyne barely shewed him by his maſter; and euen obey preſently his command, in diſcharging himſelfe of his excrements whenſoeuer he bad him (So great a power art may haue ouer nature:) would make him I beleeue, admire more at this learned beaſt, then we do at their docile Elephantes, vpon the relations we haue of them. Whereas euery one of vs knoweth, by what meanes his painefull tutor brought him to do all his trickes: and they are no whitte more extraordinary, then a fawkeners manning of a hawke, and trayning her to kill partridges, and to fly at the retriue: but do all of them (both theſe, and all other iuggling artificies of beaſtes) depend vpon the ſame, or like principles; and are knowne to be but directions of nature, ordered by one that compoſeth and leuelleth her operations to an end further off (in thoſe

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actions) then she of her selfe would ayme at. The particulars of which, we neede not trouble ourselues to meddle with.

4. Of the Orderly traine of actions performed by beasts in breeding their yong ones.

But it is time that we come to the third sort of actions performed by beastes, which we promised to discourse of. These seeme to be more admirable, then any we haue yet touched: and are chiefely concerning the breeding of their yong ones. Aboue all others, the orderly course of birds in this affaire, is most remarkable. After they haue coupled they make their nest, they line it with mosse, straw, and feathers; they lay their egges, they sett vpon them, they hatch them, they feede their yong ones, and they teach them to flye: all which they do with so continuate and regular a methode, as no man can direct or imagine a better.

But as for the regularity, orderlinesse, and continuance of these actions, the matter is easy enough to be conceiued: for seeing that the operation of the male, maketh a change in the female; and that this change beginning from the very first, groweth by time into diuers proportions; it is no wonder that it breedeth diuers dispositions in the female, which cause her to do different actions, correspondent to those diuers dispositions. Now, those actions must of necessity be constant and orderly, because the causes whence they proceed, are such.

But to determine in particular, how it cometh to passe, that euery change in the female, disposeth her to such and such actions, there is the difficulty; and it is no small one: as well, for that there are no carefull and due obseruations, made of the effects and circumstances, which should guide vs to iudge of their causes; as because these actions, are the most refined ones of sensitiue creatures; and do flow from the toppe and perfection of their nature; and are the last straine of their vtmost vigour, vnto which all others are subordinate. As in our enquiry into the motions and operations of the bodies of a lower orbe then these, we mett with some (namely the loadestone, and such like) of which it is very hard to giue an exact and plaine account; the Author of them reseruing something from our cleare and distinct knowledge; and suffering vs to looke vpon it but through a miste: in like manner we can not but expect, that in the depth of this other perfecter nature, there must be somewhat whereof we can haue but a glimmering and imperfect notion. But as in the other, it serued our turne to trace out a way, how those operations might be effected by bodies, and by locall motion (though peraduenture, we did not in euery circumstance hitt exactly vpon the right) thereby to defend ourselues from admitting those chymericall qualities, which we had already condemned, vpon all other occasions.

So I conceiue, it will be sufficient for vs in this, to shew how these actions may be done by the senses, and by the motion of corporeall spirits, and by materiall impressions vpon them; without being constrained to resort vnto an immateriall principle, which must furnish

birdes

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birdes with reaſon and diſcourſe: in which, it is not neceſſary for my purpoſe, to determine preciſely euery ſteppe, by which theſe actions are performed, and to ſettle the rigorous truth of them: but leauing that vnto thoſe, who shall take paines to deliuer the hiſtory of their nature, I will content my ſelfe with the poſſibility and probability of my cõiectures. The firſt of which qualities, I am obliged to make plaine, but the later concerneth this treatiſe no more, then it would do a man to enquire anxiouſly into the particulars of what it is that a beaſt is doing, whiles looking vpon it, at a great diſtance, he perceiueth plainely that it moueth it ſelfe: and his arrant is, but to be aſſured whether it be aliue or dead: which the mouing of it ſelfe in common, doth ſufficiently demonſtrate, without deſcending into a particular ſearch, of what his motions are.

But lett vs come to the matter: firſt I conceiue no man will make any difficulty in allowing, that it is the temper of the bloud and ſpirits in birdes (brought therevnto by the quality of their foode, and by the ſeaſon of the yeare) which maketh them accouple with one an other; and not any ayme or deſire of hauing yong ones, that occaſioneth this action in thẽ. Then it followeth that the hennes egges will encreaſe in her belly; and whẽ they grow bigge, they can not chooſe but be troubleſome vnto her; and therefore, muſt of neceſſity breede in her an inclination to reſt in ſome ſoft place, and to be ridde of them. And as we ſee a dogg or a catt preſſed by nature, ſearcheth about to find a conuenient place to diſburthen themſelues in, not only of their yong ones, but euen of their excrements; ſo do birdes, whoſe egges within them, making them heauy and vnfitt to flye, they beginne to ſitt much, and are pleaſed in a ſoft and warme place: and therevpon, they are delighted with ſtrawes and moſſe, and other gentle ſubſtances; and ſo carry them to their ſitting place: which that they do not by deſigne, is euident by the manner of it; for when they haue mette with a ſtraw or other fitt materiall, they fly not with it directly to their neſt, but firſt to a bough of ſome tree, or to the toppe of a houſe; and there they hoppe and dance a while with it in their beakes; and from thence skippe to an other place, where they entertaine themſelues in like manner: and at the laſt, they gett to their neſt: where if the ſtrawes should lye confuſedly, their endes would pricke and hurt them: and therefore they turne and alter their poſitions till they lye ſmooth: which we that looke vpon the effect, and compare them with our performing of like actions (if we had occaſion) may call a iuditious ordering of them, whereas in them, it is nothing but remouing ſuch thinges as preſſe vpon their ſenſe, vntill they cauſe them no more paine or vnquietneſſe.

Their plaſtering of their neſtes, may be atttributed to the great heat raigning in them at that time; which maketh them ſtill be dabbling in moiſt clay, and in water, and in grauell, (without which, all birdes will ſoone grow ſicke, blind, and at length dye (which for the cooleneſſe of

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it, they bring home to their neſtes in their beakes and vpon their feete; and when it groweth dry, and conſequently troubleſome to them, they wipe it off, and rubbe their durty partes vpon the place where they vſe to ſitt; and then flye for more to refresh themſelues withall.

Out of all which actions (ſett on foote by the wiſe orderer of nature, to compaſſe a remote end, quite different from the immediate end that euery one of them is done for) there reſulteth a fitt and conuenient place for theſe litle builders (that know not what they do, whiles they build themſelues houſes) to lye in, and to lay their egges in. Which the next yeare, when the like occaſion occurreth, they build againe; peraduenture then, as much through memory of the former, as vpon their temper and other circumſtances, mouing their fantaſy in ſuch ſort as we haue ſett downe.

In like manner, that whiles the Halcyon layeth and hatcheth her egges, the ſea is calme, needeth no more be attributed to the wiſedome and prouidence of that bird, in chooſing a fitt ſeaſon, then to any good nature or diſcourſe in that rouling and mercileſſe Element; as though it had a pious care of preſeruing the egges committed to his truſt: no ſuch ſupplements are requiſite to be added vnto the diſtributions of nature, who hath ſett materiall cauſes on foote, to produce a coniuncture of both thoſe effects at the ſame periode of time, for the propagation of this animals ſpecies.

In fine, both the time and the place of the Halcyons breeding, and the manner, and order, and ſeaſon of all birdes making their neſtes, proceedeth from ſecret motions, which do require great obſeruing and attention to vnderſtand them; and do ſerue for directions vnto euery bird, according to her kind, to make her neſte fitteſt for her vſe. Which ſecret motions, we can not doubt but are materiall ones, and do ariſe out of the conſtitution and temper of their bodies and ſpirits; which in like circumſtances are alike in them all: for all the birdes of one kind, do make their neſtes exactly alike; which they would not do, if this worke proceeded from reaſon in them, and were gouerned by their owne election and deſigne: as we ſee it happen amõg men vpon all occaſions, eyther of building houſes, or of making clothes, or of what action ſoeuer is guided by their reaſon gouerning their fantaſy; in all which we ſee ſo great variety and inconſtancy.

And therefore this invariability in the birdes operations, muſt proceed from a higher intellect, that hath determinately and preciſely ordered a complexe or aſſembly of ſundry cauſes, to meete infaillibly and by neceſſity, for the production of an effect that he hath deſigned: and ſo, the birdes are but materiall inſtruments to performe without their knowledge or reflection, a ſuperiour reaſons counſelles: euen as in a clocke, that is compoſed of ſeuerall pieces and wheeles, all the partes of it, do conſpire to giue notice of the ſeuerall effluxes and periodes of time, which the maker hath ordered it for.

And

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And although this be a worke of reason and discourse in him, that did sett it together; yet the instrumentall performance of it, dependeth meerely of locall motion, and of the reuolutions of bodies, so orderly proportioned to one an other, that their effects can not faile when once the engine is wound vp: in like manner then, the bird is the engine of the Artificer, infinitely more perfect, and knowing, and dexterous then a poore clockemaker; and the plummets which do make it goe, are the rowe and order of causes chained together, which by the designe of the supreme workeman, do bring to passe such effects, as we see in the building of their nestes, and in doing such other actions, as may be compared to the strickings of the clocke, and the ringing of the allarum at due times.

And as that king of China, vpon his first seeing a watch, thought it a liuing and iuditious creature, because it moued so regularly of it selfe; and beleeued it to be dead, when it was runne out; till the opening of it and the winding it vp, discouered vnto him the artifice of it: so any man may be excused, that looking vpon these strange actions, and this admirable oeconomy of some liuing creatures, should beleeue them endewed with reason, vntill he haue well reflected vpon euery particular circumstance of their nature and operations: for then he will discerne how these are but materiall instruments of a rationall Agent working by them; from whose orderly prescriptions, they haue not power to swarue in the least circumstance that is. Euery one of which considered singly by it selfe, hath a face of no more difficulty, then that (for example) an ingenier should so order his matters, that a mine should be ready to play exactly at such an houre, by leauing such a proportion of kindled match hanging out of one of the barrels of pouder, whiles in the meane time, he eyther sleepeth, or attendeth to something else.

And when you haue once gayned thus much of your selfe, to g r ee vnto an orderly course and generation of any single effect, by the power of a materiall cause working it; raise but your discourse a straine higher, and looke with reuerence and duty vpon the immensity of that prouident Architect, out of whose handes these masterpieces issue, and vnto whom it is as easy to make a chaine of causes of a thousand or of a million of linkes, as to make one linke alone: and then you will no longer sticke at allowing the whole oeconomy of those actions, to be nothing else, but a production of materiall effects, by a due ranging and ordering of materiall causes.

But lett 's returne to our theame: as we see that milke coming into the brestes of liuebearing female creatures, when th'y grow wery bigge, heateth and maketh them seeke the mouthes of their yong ones, to disburthen and coole them: so the carriage and biggenesse of the egges, heateth exceedingly the brestes and bodies of the birdes; and this causeth them to be still rubbing of their brestes, against the sides of their nestes (where vnto their vnwieldinesse then, confineth them very

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much) and with their beakes to be ſtill picking their feathers; which being then apt to fall off and mewe (as we ſee the haire of women with childe, is apt to shedde) it happeneth that by then they are ready to lay their egges, they haue a ſoft bed of their owne feathers, made in their neſtes, ouer their courſer mattraſſe of ſtrawes they firſt brought thither: and then, the egges powerfull attracting of the annoying heate from the hennes breſt (whoſe imbibing of the warmeth, and ſtonelike shell, can not chooſe but coole her much) inuiteth her to ſitt conſtantly vpon them, vntill ſitting hatcheth them; and it is euidēt, that this ſitting muſt proceed from their temper at that time, or from ſome other immediate cauſe, which worketh that effect; and not from a iudgement that doth it for a remote end: for houſewifes tell vs, that at ſuch a ſeaſon, their hennes will be ſitting in euery conuenient place they come vnto, as though they had egges to hatch, when neuer a one is vnder them: ſo as it ſeemeth that at ſuch time, there is ſome inconuenience in their bodies, which by ſitting is eaſed.

When the chickens are hatched, what wōder is it, if the litle crying of tender creatures, of a like nature and lāguage with their dāmes, do moue thoſe affectiōs or paſſions in her boſome, which cauſeth her to feede thē, and to defend, and breede them, till they be able to ſhift for themſelues? For all this there needeth no diſcourſe or reaſon; but only the motion of the bloud about the hart (which we haue determined to be paſſiō) ſtirred by the yong ones chirpinges, in ſuch ſort, as may carry them vnto thoſe actions which by nature (the ſupreme intellect) are ordered for their preſeruation. Wherein the birdes (as we haue already ſaid) are but paſſiue inſtruments, and know not why they do thoſe actions: but do them they muſt, whenſoeuer ſuch and ſuch obiects (which infaillibly worke in their due times) do make ſuch and ſuch impreſſions vpon their fantaſies, like the allarum that neceſſarilly ſtriketh, when the hand of the dyall cometh to ſuch a point; or the gunnepouder that neceſſarily maketh a ruine and breach in the wall, when the burning of the match reacheth to it.

Now this loue in the damme, growing by litle and litle weariſome and troubleſome to her; and at laſt, fading quite away; and she not being able to ſupply their encreaſed needes, which they grow euery day ſtronger to prouide for of themſelues; the ſtraight commerce beginneth to dye on both ſides: and by theſe degrees the damme leaueth her yong ones, to their owne conduct.

And thus you ſee how this long *ſeries* of actions, may haue orderly cauſes, made and chained together, by him that knew what was fitting for the worke he went about. Of which, though it is likely I haue miſſed of the right ones (as it can not chooſe but happen in all diſquiſitions, where one is the firſt to breake the yce, and is ſo ſlenderly informed of the particular circumſtances of the matter in queſtion, as I profeſſe to be in this) yet I conceiue this diſcourſe doth plainely shew, that he who hath done

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done more then we are able to comprehend and vnderſtand, may haue ſett cauſes ſufficient for all theſe effects, in a better order, and in compleater rankes, then thoſe which we haue here expreſſed: and yet in them ſo courſely hewed out, appeareth a poſſibility of hauing the worke done by corporeall agents. Surely it were very well worth the while, for ſome curious and iuditious perſon, to obſerue carefully and often, the ſeuerall ſteppes of nature in this progreſſe: for I am ſtrongly perſuaded, that by ſuch induſtry, we might in time arriue to very particular knowledge of the immediate and preciſe cauſes, that worke all theſe effects. And I cõceiue, that ſuch obſeruation needeth not be very troubleſome; as not requiring any great variety of creatures to inſtitute it vpon; for by marking carefully all that paſſeth among our homebred hennes, I beleeue it were eaſy to gueſſe very neerely at all the reſt.

THE EIGHT AND THERTIETH CHAPTER.

Of preſcience of future euentes, prouidencies, the knowing of thinges neuer ſeene b fore; and ſuch other actions, obſerued in ſome liuing creatures; which ſeeme to be euen aboue the reaſon that is in man himſelfe.

THE fourth and laſt kind of actions, which we may with aſtonishment obſerue among beaſtes, I conceiue will auayle litle to inferre out of them, that the creatures which do them, are endewed with reaſon and vnderſtanding: for ſuch they are, as if we ſhould admitt that, yet we ſhould ſtill be as farre to ſeeke for the cauſes whence they proceed. What ſhould moue a lambe to tremble at the firſt ſight of a wolfe? or a henne, at a kite neuer before ſeene? neither the grimmeſt maſtife, or the biggeſt owle, will at all affright them. 1.

why beaſts are affraide of men.

That which in the ordinary courſe of nature, cauſeth beaſtes to be affraide of men, or of other beaſtes, is the hurt and the euill they receiue from them: which coming into their fantaſie, together with the Idæa of him that did it, is alſo lodged together with it in the memory; from whence they come linked or glewed together, whenſoeuer the ſtroake of any new obiect calleth eyther of them backe into the fantaſie. This is confirmed by the tameneſſe of the birdes and beaſtes, which the firſt diſcouerers of Iſlandes not inhabitated by men, did find in thoſe they mett withall there. Their ſtories tell vs, that at their firſt arriuall vpon thoſe coaſtes, where it ſeemeth men had neuer beene; the birdes would not flye away, but ſuffered the marriners to take them in their handes: nor the beaſtes, which with vs are wilde, would runne from them: but their diſcourteous gueſtes vſed them ſo hardely, as they ſoone changed their confidence into diſtruſt and auerſion; and by litle they grew, by

their commerce with men, and by receiuing iniuries from them, to be as wilde, as any of the like kind in our partes.

From the dammes and sires, this apprehension and feare at the sight of men, so deepely rooted in them, is doubtlessely transmitted to their yong ones: for it proceedeth out of the disposition of the body, and out of the passion which is immediately made in the hart; and that is as truly a materiall motion, as any whatsoeuer can be; and must haue settled materiall instruments fitted to it, if it be constant, as well as any other naturall operation whatsoeuer: and this passion of the hart, proceedeth againe from a perpetuall connexion, of the two obiects in the memory: which being a perpetually constant thing, is as true a quality of that beastes braine in whome it is, as the being of a quicke or dull apprehension, or the being apt to know one kind of meate from an other (which is natural to the whole species) or any other quality whatsoeuer, residing in that beast.

2. How some qualities caused at first by chance in beasts, may passe by generation to the whole offspring.

Wherefore it is no wonder, that it passeth by generation to the offspring: which is a thing so common, euen in mankinde, as there can be no doubt of it: and is at the first, made by a violent cause, that greatly altereth the body: and consequently, their seede must be imbewed with a like disposition; and so it passeth together with the nature of the sire, or of the damme, into the broode. From hence proceedeth that children do loue the same meates, and exercises, that their fathers and mothers were affected with, and feare the like harmes.

This is the reason, why a grandchilde of my Lord of Dorset (whose honoured name must neuer be mentioned by me, without a particular respect, and humble acknowledgement of the noble and steady frendshippe, he hath euer beene pleased to honour we with) was alwayes extremely sicke, if but the nurse did eate any capers (against which my Lords antipathy is famous) whiles she gaue sucke to that pretty infant. The children of great Mathematicians, who haue beene vsed to busye their fantasies continually with figures and proportions, haue beene oftentimes obserued, to haue a naturall bent vnto those sciences. And we may note, that euen in particular gestures, and in litle singularities in familiar conuersation, children will oftentimes resemble their parents, as well as in the lineaments of their faces. The yong ones of excellent setting doggs, will haue a notable aptitude to that exercise; and may be taught with halfe the paines, that their sire or damme was, if they were chosen out of a race of spaniels not trained to setting. All which effects can proceed from no other cause, but (as we haue touched already) that the fantasy of the parent, altereth the temper and the disposition of his body and seede, according as it selfe is tempered and disposed: and consequently, such a creature must be made of it, as retaineth the same qualities: in such sort as it is said that sufficient tartar putt at the roote of a tree, will make the fruite haue a winy tast.

But nothing doth confirme this so much, as certaine notable accidents, whereof

whereof though euery one in particular would seeme incredible, yet the number of them, and the weight of the reporters, who are the witnesses, can not choose but purchase a generall creditt to the kind of them. These accidents are, that out of some strong imagination of the parents, but especially of the mothers, in the time of conception, the children draw such maine differences, as were incredible, if the testifying authority were not so great: but being true, they conuince beyond all question the truth we haue proposed, of the parents imagination working vpon, and making an impression in the seede, whereof children or yong ones of their kind are made. Some children of white parents are reported to haue beene blacke, vpon occasion of a blacke moores picture too much in the mothers eye. Others are said to haue beene borne with their skinnes all hairy, out of the sight of St. Iohn Baptistes picture as he was in the desert, or of some other hairy image. An other childe is famed to haue beene borne deformed, in such sort as diuels are painted, because the father was in a diuels habitt when he gott the childe.

3. How the parets fantasie doth oftentimes worke strange effects in their issue.

There was a Lady a kinswoman of mine, who vsed much to weare blacke patches vpon her face (as was the fashion among yong women) which I to putt her from, vsed to tell her in iest, that the next childe she should go with, whiles the sollicitude and care of those patches was so strong in her fantasy, would come into the world with a great blacke spott in the middest of its forehead: and this apprehension was so liuely in her imagination at the time she proued with childe, that her daughter was borne marked iust as the mother had fansied, which there are at hand witnesses enough to confirme; but none more pregnant, then the yong Lady her selfe, vpon whom the marke is yet remaining. Among other creatures, it is said that a henne hatched a chicken with a kites bill, because she was frighted with a kite, whiles the cocke was treading her. The story of Iacobs sheepe is knowne to all: and some do write, that the painting of beautifull coloured pigeons in a douehouse, will make the following race become like them: and in Authors store of such examples may be found.

To giue a reasonable and fully satisfying cause of this great effect, I confesse is very difficult: seeing that for the most part, the parents seede is made long time before the accoupling of the male and female: and though it were not, we should be mainely to seeke for a rationall ground to discourse in particular vpon it. Yet not to leaue our Reader without a hinte which way to driue his inquisition, we will note thus much, that Aristotele and other naturall Philosophers and Physitians do affirme, that in some persons the passiō is so great in the time of their accoupling, that for the present it quite bereaueth them of the vse of reason: and that they are for the while, in a kind of short fitt of an epylepsie. By which it is manifest, that aboundance of animal spirits do then part from the head, and descend into those partes which are the instruments of generation. Wherefore, if there be aboundance of speciefes of any one kind

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of obiect then ſtrong in the imagination, it muſt of neceſſity be carryed downe together with the ſpirits into the ſeede: and by conſequence, when the ſeede infected with this nature, beginneth to ſeperate and diſtribute it ſelfe, to the forming of the ſeuerall partes of the Embryon, the ſpirits which do reſort into the braine of the child (as to their proper Element) and from thence do finish all the outward caſt of its body (in ſuch ſort as we haue aboue deſcribed) do ſometimes happen to fill certaine places of the childes body, with the infection and tincture of this obiect; and that according to the impreſſion with which they were in the mothers fataſy: for ſo we haue ſaid, that thinges which come together into the fantaſy, do naturally ſticke together in the animall ſpirits. The hairyneſſe therefore, will be occaſioned in thoſe partes, where the mother fanſyed it to be: the colour likewiſe, and ſuch extancies or defects, as may any way proceed from ſuch a cauſe, will happen to be in thoſe partes, in which they were fanſyed. And this is as farre, as is fitt to wade into this point, for ſo generall a diſcourſe as ours is; and more thē was neceſſary for our turne: to the ſeruing whereof, the verity of the fact only, and not the knowledge of the cauſe, was required: for we were to shew no more, but that the apprehenſions of the parents, may deſcend to the children.

Out of this diſcourſe, the reaſon appeareth, why beaſtes haue an auerſion from thoſe, who vſe to do them harme: and why this auerſion deſcendeth from the old ones to their broode; though it should neuer haue happened that they had formerly encountred with, what at the firſt ſight they flye from and auoyde.

4. Of Antipathies.

But yet the reaſon appeareth not; why (for example) a sheepe in Englād (where there are no wolues bred, nor haue beene theſe many ages) should be affraide, and tremble at ſight of a wolfe, ſince neyther he, nor his damme or ſire, nor theirs in multitudes of generations, euer ſaw a wolfe, or receiued hurt by any. In like manner, how should a tame weaſell brought into England from Ireland (where there are no poyſonous creatures) be affraide of a toade as ſoone as he ſeeth one? Neyther he, nor any of his race, euer had any impreſſions following harme, made vpon their fantaſies: and as litle can a lyon receiue hurt from a houſehold cocke: therefore we muſt ſeeke the reaſons of theſe and ſuch like antipathies, a litle further, and we shall find them hanging vpon the ſame ſtring, with ſympathies proportionable to them.

Lett vs goe by degrees: we dayly ſee that dogges, will haue an auerſion from glouers, that make their ware of dogges skinnes: they will barke at them, and be churliſh to them, and not endure to come neere them, although they neuer ſaw thē before. The like hatred they will expreſſe to the dogge killers in the time of the plague, and to thoſe that flea dogges. I haue knowne of a man that vſed to be employed in ſuch affaires, who paſſing ſometimes ouer the groundes neere my mothers houſe (for he dwelled at a village not farre off) the dogges would winde him at a very great diſtance, and would all runne furiouſly out the way he was, and fiercely

fiercely fall vpon him; which made him goe alwayes well prouided for them: and yet he hath beene sometimes hard put to it, by the fierce mastifes there, had it not beene for some of the seruantes coming in to his reskew; who by the frequent happening of such accidents, were warned to looke out when they obserued so great commotion and fury in the dogges, and yet perceiued no present cause for it. Warreners obserue, that vermine will hardly come into a trappe, wherein an other of their kind hath beene lately killed: and the like happeneth in mouse-trappes, into which no mouse will come to take the bayte, if a mouse or two haue already beene killed in it; vnlesse it be made very cleane, so that no sent of them remaine vpon the trappe: which can hardly be done on the suddaine otherwise then by fire.

It is euident, that these effects are to be referred, to an actiuity of the obiect vpon the sense; for some smell of the skinnes, or of the dead dogges, or of the vermine, or of the mice, can not choose but remaine vpon the men and vpon the trappes; which being altered from their due nature and temper, must needes offend them. Their conformity on the one side (for something of the canine nature remaineth) maketh them haue easy ingression into them; and so they presently make a deepe impression: but on the other side, their distemper from what they should be, maketh the impression repugnant to their nature, and be disliked by them, and to affect them worse, then if they were of other creatures, that had no conformity with them: as we may obserue, that stinkes offend vs more, when they are accompanied with some weake perfume, then if they sett vpon vs single; for the perfume getteth the stinke easyer admittance into our sense: and in like manner, it is said that poisons are more dangerous, when they are mingled with a cordiall that is not able to resist them: for it serueth to conuey them to the hart, though it be not able to ouercome their malignity.

From hence then it followeth, that if any beast or bird do prey vpon some of an other kind, there will be some smell about them, exceedingly noysome to all others of that kind: and not only to beastes of that same kind; but (for the same reason) euen to others likewise, that haue a correspondence and agreement of temper and constitution with that kind of beast, whose hurt is the originall cause of this auersion. Which being assented vnto, the same reason holdeth to make those creatures, whose constitutions and tempers do consist of thinges repugnant and odious to one an other, beat perpetuall enmity, and flye from one an other at the first sight, or at the least, the sufferer from the more actiue creature: as we see among those men, whose vnhappy trade and continuall exercises it is to empty iakeses, such horride stinkes are by time growne so conformable to their nature, as a strong perfume will as much offend them, and make them as sicke, as such stinks would do an other man bred vp among perfumes: and a cordiall to their spirits, is some noysome smell, that would almost poysone an other man. And thus, if in the

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breath of the wolfe, or in the ſteame coming from his body, be any quality offenſiue to the lambe (as it may very well be, where there is ſo great a contrariety of natures) it is not ſtrange, that at the firſt ſight and approach of him, he should be diſtempered, and fly from him; as one fighting cocke will do from an other, that hath eaten garlike: and the ſame happeneth between the weaſell and the toade, the lyon and the cocke, the toade and the ſpider, and ſeuerall other creatures, of whom like enmities are reported.

All which are cauſed in them, not by ſecret inſtincts, and antipathies, and ſympathies, whereof we can giue no account; (with the bare ſound of which wordes, moſt men do pay themſelues, without examining what they meane;) but by downe right materiall qualities, that are of contrary natures (as fire and water are) and are eyther begotten in them in their originall conſtitution, or are implanted in them afterwardes by their continuall foode, which nourishing them, changeth their conſtitution to its cõplexion. And I am perſuaded this would goe ſo farre, that if one man were nourished continually with ſuch meate (and greedily affected it) which an other had auerſion from, there would naturally follow much diſlike betweene them; vnleſſe ſome ſuperiour regard, should maſter this auerſion of the ſenſe. And I remember to haue ſeene two notable examples of it: the one in Spaine, of a Gentleman that had a horrour to garlike, who (though he was very ſubiect to the impreſſions of beauty) could neuer weane himſelfe from an auerſion he had ſettled him to a very handſome woman, that vſed to eate much garlike, though to winne him, she forebore the vſe of that meate, which to her was the moſt ſauory of all others. And the like I knew in Englãd betweene two, whereof the one did extremely loue cheeſe, and the other as much hated it, and would fall into a ſtrange agony, and be reduced (one would thinke) to the point of death, if by inaduertence or others tryall of him, he had ſwallowed neuer ſo litle, of what the other would haue quitted all meates elſe to liue vpon.

And not only ſuch auerſions, as ſpring from differences of complexions in the conſtitutions of ſeuerall animals, do cauſe theſe effects of feare, and of trembling, and of flying from thoſe that do make ſuch impreſſions; but euen the ſeeing them angry and in fury doth the like: for ſuch paſſions do alter the ſpirits; and they iſſuing from the body of the animal in paſſion, can not chooſe but be receiued by an other in a different manner, then if they were of an other temper. Then if the one kind be agreeable to their nature, the other muſt needes be diſpleaſing. And this may be the reaſon why bees neuer ſting ſuch as are of a milde and gentle diſpoſition; and will neuer agree with others, that are of a froward and angry nature. And the ſame one may obſerue among dogges: and peraduenture, a mans fantaſy may be raiſed to ſuch a height of fury, that the fierceſt beaſtes may be affraide to looke vpon him; and can not endure that thoſe maſtering ſpirits, which

ſtreame

ſtreame out of the mans eyes should come into his; ſo much they diſtemper his fantaſy: and therefore he will turne away from the man, and auoyde him. Which diſcourſe may be cõfirmed by ſundry examples of lyons and beares, that haue runne from angry and confident men, and the like. Since then, a man that in his naturall hew giueth no diſtaſt, doth ſo much affright fierceſt beaſtes, when he putteth on his threatning lookes; it is no wonder, that beaſtes of a milder and ſofter nature, should haue feare of him ſettled in them, when they neuer ſaw him otherwiſe then angry, and working miſchiefe to them. And ſince their brood do receiue from their parents, a nature eaſily moued vnto feare or anger, by the ſight of what moued them, it is not ſtrange, that at the firſt ſight, they should tremble or ſwell, according as the inward motion of the ſpirits affordeth.

Now if this hath rendered the birdes in the wilde Iſlandes affraide of men, who otherwiſe would be indifferent to them, it is no maruayle to ſee more violent effects in the lambes auerſion from the wolfe, or in the larkes from the hobbey; ſince they peraduenture haue ouer and aboue the hurt they vſe to do them, a difformity in their conſtitutions: and therefore, though a larke will flye as well from a man as from a hobbey, yet becauſe there is one cauſe more for his diſlike againſt the hobbey, then againſt the man (namely the difformity of their conſtitutions) he will flye into the mans hand, to auoyde the hawkes talons.

Vnto ſome of theſe cauſes all antipathies may be reduced: and the like reaſon may be giuen for the ſympathies we ſee betweene ſome creatures. The litle corporeities which iſſue from the one, haue ſuch a conformity with the temper of the other, that it is thereby moued to ioyne it ſelfe vnto the body from whence they flow, and affecteth vnion with it in that way, as it receiueth the impreſſion. If the ſmell do pleaſe it, the beaſt will alwayes be ſmelling at it: if the taſt, nothing shall hinder it from feeding vpon it when it can reach it. The fishermen vpon the banke ouer againſt newfound land, do report that there flocketh about them a kind of bird, ſo greedy of the fishes liuers which they take there, as that to come at them and feede vpon them, they will ſuffer the men to take them in their handes; and will not fly away, as long as any of their deſired meate is in their eye: whence the French men that fish there, do call them *Happe foyes*. The like power, a certaine worme hath with nigthingales. 5. Of Sympathies.

And thus you ſee, how they are ſtrong impreſſions vpon ſenſe, and not any diſcourſe of reaſon, that do gouerne beaſtes in their actions: for if their auoyding men, did proceed from any ſagacity in their nature, ſurely they would exerciſe it, when they ſee that for a bitte of meate they incurre their deſtruction: and yet neyther the examples of their fellowes killed before their eyes in the ſame purſuite, nor the blowes which themſelues do feele; can ſerue them for warning, where the ſenſe is ſo ſtrongly affected: but as ſoone as the blow that remoued them is paſſed, (if it miſſe

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killing or laming them) and they be gotten on wing againe, they will returne to their prey as eagerly and as confidently, as if nothing were there to hinder them.

6. That the Antipathy of beasts towards one an other, may be taken away by assuefaction.

This then being the true reason of all sympathy and antipathy, we can not admitt that any beastes should loue or hate one on other, for any other cause, then some of those we haue touched. All which are reduced to locall motion, and to materiall application of bodies of one nature, to bodies of an other; and are as well transmitted to their yong ones, as begotten in themselues : and as the satisfying of their sense, is more preualent in the *Happe foyes*, then the feare which from other groundes is begotten in their fantasy; and so maketh them approach to what the other would driue them from.

In like manner, any auersion of the fantasy may be mastered not only by a more powerfull agent vpon the present sense, but also by assuefaction, and by bringing into the fantasy with pleasing circumstances that obiect which before was displeasing and affrightfull to it : as we see that all sortes of beastes or birdes, if they be taken yong may be tamed and will liue quietly together. Dogges that are vsed to hunt and kill deere, will liue frendly with one that is bred with them; and that fawne which otherwise would haue beene affraide of them, by such education groweth confident and playeth boldely with them. Of which we can no longer remaine in doubt, if we will beleeue the story of a tygar (accounted the cruellest beaste of all others) who being shutt vp with a deere, that had beene bred with him from a kidde, and from his being a whelpe; and no meate giuen him, vsed meanes to breake prison, when was halfe starued, rather then he would hurt his familiar frend. You will not suspect, that it was a morall cõsideration, which made him so kinde: but the deere had neuer come into his fantasy accompained with other circumstances, then of play or of warmth: and therefore hunger (which calleth only the species of meate out of the memory into the fantasy) would neuer bring the deere thither, for remedy of that passion.

And that which often happeneth to those men, in whom the fantasy only worketh, is not much vnlike to this: among whom I haue seene some frenetike persons, that if they be persuaded they are tyed, and can not stirre from the place where they are; they will lye still, and make great complaintes for their imprisonnement; and not goe a steepe, to reach any meate or drinke, that should lye in sight neere them, although they were neuer so much pressed with hunger or with thirste. The reason is euident, for the apprehension of being tyed, is so strong in their fantasy, that their fantasy can send no spirits into other partes of their body, whereby to cause motion.

And thus the deere was beholding to the tygars fantasy, not to his discourse of morall honesty, for his life. The like of this tygar and deere, is to be seene euery day in the tower of London; where a litle dogge, that was bred with a lyon from his birth, is so familiar and bold with them,

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that they not only sleepe together, but sometimes the dogge will be angry with him, and will bite him; which the lyon neuer resenteth from him, though any other dogge that is putt to him, he presently teareth in pieces.

And thus we plainely see, how it cometh about, that beastes may haue strange auersions from thinges, which are of an annoying or destructiue nature to them, euen at the first sight of them: and againe, may haue great likings of other thinges, in a manner contrary to their nature, without needing to allow them reason, whereby to discourse and iudge what is hurtfull to them, or to instruct the tygar we haue spoken of, or Androdus his lyon, the duties of frendshippe and of gratitude.

7. Of longing markes seene in children.

The longing markes which are often times seene in children, and do remaine with them all their life, seeme to be an offspring of the same roote or cause: but in truth, they proceed from an other, although of kinne to this: for the operation of the seede is passed, when these longing markes are imprinted; the child being then already formed and quickened; and they seeme to be made suddainely, as by the print of a seale. Therefore to render the cause of them, lett vs consider an other sympathy, which is more plaine and common. We see that the laughing of one man, will sett an other on laughing that seeth him laugh, though he know not the cause why the first man laugheth: and the like we see in yawning and stretching, which breedeth alike effect in the looker on. I haue heard of a man, that seing a rosted pigge, after our English fashion with the mouth gaping, could not shutt his owne mouth as long as he looked vpon the pigges: and of an other, that when he saw any man make a certaine motion with his hand, could not choose but he must make the same: so that, being a tyler by his trade, and hauing one hand imployed with holding his tooles, whiles he held himselfe with the other vpon the eaues of a house he was mending, a man standing below on the ground, made that signe or motion to him; whereupon he quitted his holdfast to imitate that motion, and fell downe, in danger of breaking his necke.

All these effects, do proceed out of the action of the seene obiect vpon the fantasy of the looker on: which making the picture or likenesse of its owne action in the others fantasy, maketh his spirits runne to the same partes; and consequently, moue the same members, that is, do the same actions. And hence it is, that when we heare one speake with loue and tenderneſse of an absent person, we are also inclined to loue that person, though we neuer saw him, nor heard of him before: and that whatsoeuer a good oratour deliuereth well, (that is, with a semblance of passion agreeable to his wordes) rayseth of its owne nature, like affection in the hearers: and that generally men learne and imitate (without designe) the customes and manners of the company they much haunt.

To apply this to our intent, it is easy to conceiue, that although the

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childe in the mothers wõbe, can neyther see nor heare what the mother doth; neuertheleſſe there can not paſſe any great or violent motion in the mothers body, whereof ſome effect doth not reach vnto the childe, which is then, one continuate piece with her: and the proper effect of motion or of trembling in one body, being to produce a like motion or a trembling in an other, (as we ſee in that ordinary example of tuned ſtrinｇes, whereof the one is moued at the ſtriking of the other, by reaſon of the ſtroake giuen to the ayre, which finding a moueable eaſily moued with a motion of the ſame tenour, communicateth motion vnto it) it followeth that the fantaſy of the childe, being as it were well tuned to the fantaſy of the mother, and the mothers fantaſy making a ſpeciall and a very quicke motion in her owne whole body, (as we ſee that ſuddaine paſſions doe) this motion or trembling of the mother, muſt needes cauſe the like motion and trembling in the childe, euen to the very ſwiftneſſe of the mothers motion. Now as we ſee when one blusheth, the bloud cometh into his face, ſo the bloud runneth in the mother to a certaine place, where she is ſtrucken by the thing longed for: and the like happening to the childe, the violence of that ſuddaine motion, dyeth the marke or print of the thing in the tender skinne of it: the bloud in ſome meaſure piercing the skinne, and not returning wholy into its naturall courſe: which effect is not permanent in the mother, becauſe her skinne being harder, doth not receiue the bloud into it, but ſendeth it backe againe, without receiuing a tincture from it.

8. Why diuers men hate ſome certaine meates, and particularly cheeſe.

Farre more eaſy is it, to diſcouer the ſecret cauſe of many antipathies or ſympathies, which are ſeene in children, and endure with them the greateſt part, if not the whole terme of their life, without any apparent ground for them: as, ſome do not loue cheeſe, others garlike, others duckes, others diuers other kindes of meate, which their parents loued well; and yet in token that this auerſion is naturall vnto them, and not ariſing from ſome diſlike accidentally taken and imprinted in their fantaſy, they will be much harmed if they chance to eate any ſuch meate; though by the much diſguiſing it, they neither know, nor ſo much as ſuſpect they haue done ſo. The ſtory of the Lady Hẽnage (who was of the bedchamber to the late Queene Elizabeth) that had her checke bliſtered by laying a roſe vpon it whiles she was a ſleepe, to try if her antipathy againſt that flower, were ſo great as she vſed to pretend, is famous in the Court of England. A kinſman of mine, whiles he was a childe, had like to haue dyed of drought, before his nurſe came to vnderſtand, that he had an antipathy againſt beere or wine; vntill the tender nature in him, before he could ſpeake, taught him to make earneſt ſignes for water, that by accident he ſaw; the greedy drinking of which, cured preſently his long languishing and pining ſickeneſſe: and ſuch examples are very frequent.

The cauſe of theſe effects many times is, that their mothers, vpon their firſt ſuppreſſion of their vſuall euacuations, (by reaſon of their being

being with child) toke ſome ſtrong diſlike to ſuch thinges, their ſtomackes being then oppreſſed by vnnaturall humours, which ouerflow their bodies vpon ſuch retentions; and which make them oftentimes ſicke and prone to vomiting, (eſpecially in the mornings, whiles they are faſting) and ſometimes to deſire earneſtly (which they call *longing*) to feede vpon ſome vnwholeſome, as well as ſome particular wholeſome thinges; and otherwhiles, to take auerſion againſt meates, which at other ſeaſons they affected well. Now the child being nourished by the ſo imbued bloud of the mother, no wonder if it taketh affections or diſlikes, conformable to thoſe which at that preſent raigne in the mother: the which for the moſt part vſed to be purged away, or are ouerwhelmed by the maſtering qualities of better aliments ſucceding: but if by ſome miſchance, they become too much grafted in the childes ſtomacke, or in ſome other part, through which the maſſe of bloud muſt paſſe; then the child getteth an auerſion from thoſe meates: and we often ſee, that people retaine a ſtrong conuerſion to ſuch meates or drinkes, as their mothers affected much or longed for, whiles they bred child of them.

And thus we will leaue this particular; adding only one note, why there are more perſõs generally, who haue antipathy againſt cheeſe, thẽ againſt any one ſort of meate beſides whatſoeuer. A principal reaſon of which ſymptome (where the precedent one hath not place) I cõceiue to be, that their nurſes proued with child, whiles they gaue them ſucke. for I haue by experience found it to haue beene ſo, in as many as I haue made inquiry into. And it is very conformable to reaſon; for the nurſes milke, curdling in her breſt vpon her breeding of child, and becoming very offenſiue to the childes tender ſtomacke, (whoſe being ſicke obligeth the parents to change the nurſe, though peraduenture they know nothing of the true reaſon that maketh her milke vnnaturall) he hath a diſlike of cheeſe (which is ſtrong curdled milke) euer after ſettled in him; as people that haue once ſurfeted violently of any meate, ſeldome arriue to brooke it againe.

9. Concerning the prouidence of Aunts in laying vp in ſtore for winter.

Now, as concerning thoſe animals who lay vp in ſtore for winter, and ſeeme therein to exerciſe a rationall prouidence; who ſeeth not, that it is the ſame humour, which moueth rich miſers to heape vp wealth, euen at their laſt gaſpe, when they haue no child nor friend to giue it to, nor think of making any body their heires? Which actions becauſe they haue no reaſon in them, are to be imputed to the paſſion or motion of the materiall appetite. In the doing of them, theſe ſteppes may be obſerued; firſt the obiect preſenting it ſelfe to the eye, prouoketh loue and deſire of it; eſpecially if it be ioyned with the memory of former want: then, this deſire ſtirreth vp the animal (after he hath fedde himſelfe) to gather into the place of his chiefe reſidence, as much of that deſired obiect as he meeteth withall: and whenſoeuer his hunger returning, bringeth backe into his fantaſy the memory of his meate, it being ioyned with the

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memory of that place (if he be abſent from it) he preſently repaireth thither, for reliefe of what preſſeth him: (and thus dogges when they are hungry, do rake for bones they had hidden when their bellies were full.) Now if this foode, gathered by ſuch prouidence (which is nothing elſe, but the conformity of it, working vpon him by his ſenſe) and layed vp in the place, where the owner of it reſideth, (as the corne is, which the auntes gather in ſummer) be eaſily portable, he will carry it abroad with him the firſt time he ſtirreth after a long keeping in; for then nothing worketh ſo powerfully in his fantaſy, as his ſtore; and he will not eaſily part from it, though other circumſtances inuite him abroad. From hence it proceedeth, that when a faire day cometh after long foule weather, the auntes, who all that while kept cloſe in their dennes with their corne lying by them, do then come abroad into the ſunne, and do carry their graine along with them: or peraduenture it happeneth, becauſe the precedent wett weather, hath made it grow hoat, or muſty, or otherwiſe offenſiue within; and therefore they carry it out, as ſoone as themſelues dare peepe abroad; which is, when the faire weather, and heate of the day, inuiteth them out into the open ayre: and before night that they returne into their holes, the offenſiue vapours of the corne are exhaled and dryed vp, and moue their fantaſies no longer to auerſion: whereupon they carry it backe againe; hauing then nothing but their long contracted loue vnto it to worke vpon them. The like whereof men doing by diſcourſe, to ayre their corne, and to keepe it ſweete, and the ſame effect following herein, they will preſently haue it, that this is done by the auntes, for the ſame reaſon, and by deſigne. Then the moyſture of the earth ſwelling the graine, and conſequently, making it beginne to shoote at the endes (as we declared, when we ſpoke of the generation of plantes; and as we ſee in the moyſtening of corne to make malt of it) thoſe litle creatures, finding that part of it more tender and iuicy then the reſt, do nibble vpon it there, and do feede themſelues firſt with that, which conſequently hindereth the groweth of the corne. And here againe, men will contend that this muſt be done by prouidence and diſcourſe, to preuent that their ſtore should not grow out of their reach, and changing nature, become vſeleſſe to them in their neede.

10. Concerning the foreknowing of beaſts.

To conclude, the foreknowing of beaſtes is nothing elſe, but their timely receiuing impreſſions, from the firſt degrees of mutation in thinges without them; which degrees are almoſt imperceptible to vs, becauſe our fantaſies and ſpirits, haue otherwiſe ſuch violent agitations, more then theirs, which hinder them from diſcerning gentle impreſſiós vpon them. If you be at ſea, after a long calme, a while before a gaile bloweth to fill your ſailes, or to be diſcernable by your ſenſe in quality of wind, you shall perceiue the ſea beginne to wrinkle his ſmooth face that way the wind will come; which is ſo infaillible a ſigne that a gaile will come from that coaſt, as marriners immediately fall to trimming their ſailes accordingly; and vſually, before they can haue done, the wind is with

with them: shall we therefore say that the sea hath a prouidence to foresee which way the wind will blow? Or that the cornes vpon our toes, or callusses, or broken bones, or ioyntes that haue beene dislocated, haue discourse, and can foretell the weather? It is nothing else, but that the wind rising by degrees, the smooth sea is capable of a change by it, before we can feele it: and that the ayre, being changed by the forerunners of worse weather, worketh vpon the craziest partes of our body, when the others feele not so small a change: so beastes are more sensible then we (for they haue lesse to distract them) of the first degrees of a changing weather: and that mutation of the ayre without them, maketh some change within them, which they expresse, by some outward actions or gestures.

Now they who obserue, how such mutations and actions are constantly in them, before such or such weather, do thinke they know beforehand, that raine (for example) or wind, or drought is coming, according to the seuerall signes they haue marked in them: which proceedeth out of the narrownesse of their discourse, that maketh them resort to the same causes, whensoeuer they meete with like effects: and so they conceiue, that thinges must needes passe in beastes, after the same tenour, as they do in mẽ. And this is a generall, and maine errour, running through all the conceptions of mankind, vnlesse great heede be taken to preuent it, that what subiect soeuer they speculate vpon, whether it be of substances, that haue a superiour nature to theirs, or whether it be of creatures inferiour to them, they are still apt to bring them to their owne standard, and to frame such conceptions of them, as they would do of themselues: as when they will haue Angels discourse, and moue, and be in a place, in such sort as is naturall to men; or when they will haue beastes rationate and vnderstand, vpon their obseruing some orderly actions performed by them, which in men would proceed from discourse and reason. And this dangerous rocke (against which many fine conceptions do suffer shipperacke) whosoeuer studyeth truth, must haue a maine caution to auoyde.

Sed nos immensum spatijs confecimus æquor:
Et iam tempus equum fumantia soluere colla.

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THE CONCLVSION OF THE FIRST TREATISE.

THus at the laſt (by Gods aſſiſtance) we are clymbed vp to the toppe of the hill; from whence looking downe ouer the whole region of bodies, we may delight our ſelues, with ſeeing what a height the weary ſteppes we aſcended by, haue brought vs vnto. It is true, the path we haue walked in, is of late ſo vntrodden, and ſo ouergrowne with bryars, as it hath not beene without much labour, that we haue made our way through. And peraduenture, it may ſeeme toyleſome vnto others to follow vs, eſpecially ſuch as are not much enured to like iourneyes: but I hope, the fruite which both we and they are now arriued to gather of our paines, in this generall view we haue taken of the empire of matter, and of corporeall agents, is ſuch, as none of vs hath reaſon to be ill ſatisfyed with the employing of them. For what can more powerfully delight, or more nobly entertaine an vnderſtanding ſoule, then the ſearch and diſcouery of thoſe workes of nature, which being in their effects ſo plainely expoſed to our eyes, are in their cauſes ſo abſtruſe and hidden from our comprehenſion, as (through deſpaire of ſucceſſe) they deterre moſt men from inquiring into them?

And I am perſuaded, that by this ſummary diſcourſe (short indeede in regard of ſo large a ſcope, how euer my lame expreſſions may peraduenture make it appeare tedious) it appeareth euidently, that none of natures greateſt ſecrets, whereof our ſenſes giue vs notice in the effects, are ſo ouershaded with an impenetrable veyle, but that the diligent, and wary hand of reaſon, might vnmaske them, and shew them to vs in their naked and genuine formes, and delight vs with the contemplation of their natiue beauties; if we had as much care and conſtancy in the purſuite of them, as we dayly ſee men haue in heaping vp of wealth; or in ſtriuing to ſatisfy their boundeleſſe ambitions; or in making their ſenſes ſwimme in the muddy lake of baſe and contemptible pleaſures. For who shall througly conſider and weigh what we haue hitherto ſaid, will plainely ſee a continuall and orderly progreſſe, from the ſimpleſt, heigheſt, and moſt common conception, that we frame of a body in generall, vnto the furtheſt and moſt abſtruſe effects, that in particular are to be found in any body whatſoeuer: I meane, any that is meerely corporeall, without mixture of a nobler nature; for hitherto we haue not moued, nor ſo much as looked out of that orbe. He shall find one continued thridde, ſpunne out from the beginning to the end. He will ſee, that the various twiſting of the two ſpecieſes of *Bodies*, *Rare*, and

and *Denſe*, do make the yarne, of which all thinges and actions within the sphere of matter, are wouen.

And although peraduenture, in the drawing out of the thridde, there may be some litle brackes, or the stuffe made of it, be not euery where so close wrought, as a better workeman, at more leisure might haue done; yet truly, I beleeue, that the very consent of thinges throughout is such, as demonstrateth, that the maine contexture of the doctrine I haue here touched, is beyond quarrelling at. It may well be that in sundry particulars, I haue not lighted vpon exact truth: and I am so farre from maintaining peremptorily any thing I haue here said, as I shall most readily harken to whatsoeuer shall be obiected against it; and be as ready vpon cause, to desert my owne opinions, and to yield vnto better reason. But withall, I conceiue, that as the fayling of a bricke here and there in the rearing of the walles of a house, doth nothing at all preiudice the strength and security of the fabrike; no more (I hope) will the slight escapes, which so difficult a taske as this is subiect vnto, endamage or weaken the maine body of what I haue here deliuered. I haue not yet seene any piece vpon this subiect, made vp with this methode; beginning from the simplest and plainest notions, and composing them orderly, till all the principall variety which their nature is capable of, be gone through: and therefore it can not be expected, but that the first modell of this kind (and moulded by one distracted with continuall thoughts of a much different straine; and whose exercise, as well as profession, hath allowed him but litle commerce with bookes and study) must needes be very rough hewed, and require a great deale of polishing. Which whosoeuer shall do, and be as exact and orderly in treating of Phylosophy and Theology, as Mathematicians are in deliuering their sciencies, I do assure my selfe, that *Demonstrations* might be made, and would proceed in them as currently, and the conclusions be as certaine and as full, as in the Mathematikes themselues. But that is not all: these demonstrations would haue the oddes exceedingly of the other, and be to vs, inestimably more aduantagious: for out of them, do spiring much higher and nobler effects, for mans vse and life, then out of any Mathematicall ones; especially when they extend themselues to the gouuernement of *Man* as he is *Man*: which is an art, as farre beyond all the rules of Physike, or other gouuernement of our body, or temporall goodes, as the end is beyond the meanes we employ to gaine it; for all the others, do but serue instrumentally to this end, *That we may liue well:* whereas these do immediately teach it.

These are the fruites in generall, that I hope may in some measure, grow out of this discourse, in the handes of equall and iuditious Readers: but the particular ayme of it, is to shew what actions can proeeed from a body, and what can not. In the conduct whereof, one of our chiefe endeauours hath beene to shew, that those actions which seeme to draw strongly into the order of bodies, the vnknowne nature of certaine

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entities named *Qualities*; eyther do or may proceed, from the same causes, which produce those knowne effects, that all sides agree, do not stand in neede of any such mysticall Philosophy. And this being the maine hinge, vpon which hangeth and moueth, the full and cleare resoluing of our maine, and great question, *Of the Immortality of the Soule*; I assure my selfe, the paines I haue taken in this particular, will not be deemed superfluous or tedious: and withall, I hope I haue employed them with so good successe, as hence foreward, we shall not be any more troubled, with obiections drawne from their hidden and incomprehensible nature: and that we stand vpon euen ground, with those of the contrary opinion: for since we haue shewed, how all actions may be performed among bodies, without hauing any recourse to such *Entities* and *Qualities* as they pretend and paint out to vs; it is now their part (if they will haue them admitted) to proue that in nature there are such.

Hauing then brought the Philosophy of bodies vnto these termes; that which remaineth for vs to performe, is to shew that those actions of our soule, for which we call her a spiritt, are of such a nature, as they can not be reduced into those principles, by which all corporeall actions are effected. For the proofe of our originall intent, no more then this, can be exacted at our handes; so that if our positiue proofes, shall carry vs yet beyond this, it can not be denyed, but that we giue ouermeasure, and do illustrate with a greater light, what is already sufficiently discerned. In our proceeding, we haue the precedency of nature: for laying for our ground, the naturall conceptions which mankind maketh of quantity; we find that a body is a meere passiue thing, consisting of diuers partes, which by motion may be diuersly ordered; and consequently, that it is capable of no other change or operation, then such as motion may produce, by various ordering the diuers partes of it: and then, seeing that *Rare* and *Dense*, is the primary and adequate diuision of *Bodies*; it followeth euidently, that what can not be effected by the various disposition of rare and dense partes, can not proceed or be effected by a pure body: and consequently, it will be sufficient for vs to shew, that the motions of our soules are such: and they who will not agree to this conclusion, must take vpon them to shew, that our first premisse is defectiue; by prouing that other vnknowne wayes are necessary, for bodies to be wrought vpon or to worke by: and that the motion, and various ordering of rare and dense partes in them, is not cause sufficient for the effects we see among them. Which whosoeuer shall attempt to do, must remember that he hath this disaduantage before he beginneth, that whatsoeuer hath beene hitherto discouered in the science of bodies, by the helpe, eyther of Mathematikes or Physickes, it hath all beene resolued and hath fallen, into this way which we declare.

Here I should sett a periode to all further discourse concerning this first Treatise of bodies, did I not apprehend, that the preiudice of Aristotles

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Aristotles authority, may dispose many to a harsh conceite of the draught we haue made. But if they knew how litle reason they haue to vrge that against vs, they would not crye vs downe for contradicting that oracle of nature: not only because he himselfe, both by word, and by example, exhorteth vs, when verity leadeth vs an other way, to forsake the trackes, which our forefathers haue beaten for vs, so we do it with due respect and gratitude for the much they haue left vs: nor yet becausc Christian Religion, as it will not heare of any man (purely a man) free from sinne, so it inclineth to persuade vs, that no man can be exempt from errour; and therefore it sauoureth not well, to defend peremptorily any mans sayings (especially if they be many) as being vncontrolable; how beit I intend not to preiudice any person, that to defend a worthy authors honour, shal endeauour to vindicate him from absurdities and grosse errors: nor lastly becausc it hath euer beene the common practise of all graue Peripatetikes and Thomistes, to leaue their Masters, some in one article, some in an other: but indeede, becausc the very truth is, that the way we take, is directly the same solide way, which Aristotle walked in before vs: and they who are scandalised at vs for leauing him, are exceedingly mistaken in the matter: and out of the sound of his wordes (not rightly vnderstood) do frame a wrong sense of the doctrine he hath left vs, which generally we follow.

Lett any vnpartiall Aristotelian answere, whether the conceptions we haue deliuered of *Quãtity*, of *Rarity* and *Dẽsity*, of the *foure first Qualities*, of the *combinations* of the *Elements*, of the *repugnance of vacuities*, be not exactly and rigorously Aristotles? Whether the motion of weighty and light thinges, and of such as are forced, be not by him, as well as by vs, atttibuted to externe causes? In which all the differẽce betweene vs is, that we enlarge ourselues to more particulars then he hath done. Lett any man reade his bookes of Generation and Corruption, and say whether he doth not expressely teach, that mixtion (which he deliuereth to be the generation or making of a mixt body) is done *per minima*; that is in our language and in one word, by atomes; and signifyeth, that all the qualities, which are naturall qualities following the composition of the Elements, are made by the mingling of the least partes or atomes of the said Elements; which is in effect to say, that all the nature of bodies, their qualities, and their operations, are compassed by the mingling of atomes: the shewing and explicating of which, hath beene our labour in this whole Treatise. Lett him reade his bookes of Meteores, and iudge whether he doth not giue the causes of all the effects he treateth of there, by mingling and seperating of great and litle, grosse and subtile, fiery and watry, aery and earthy partes, iust as we do. The same he doth in his *Problemes*, and in his *Parua naturalia*, and in all other places, whereſoeuer he hath occasion to render Physically, the causes of Physicall effects. The same do Hippocrates and Galen: the same, their Master Democritus; and with them the best sort of Physitians: the same do

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Alchymiſtes, with their Maſter Geber; whoſe maxime to this purpoſe, we cited aboue: the ſame do all naturall Philoſophers, eyther auncient commentatours of Ariſtotle, or elſe moderne inquirers into naturall effects, in a ſenſible and vnderſtandable way: as who will take the paines to looke into them, will eaſily perceiue. Wherefore, lett any iuditious Reader that hath looked further into Ariſtotle then only vpon his Logicall and Metaphyſicall workes, iudge whether *in bulke* our doctrine be not conformable to the courſe of his, and of all the beſt Philoſophers that haue beene and are; though in *detaile* or particulars, we ſometimes mingle therewith, our owne priuate iudgements: as euery one of them, hath likewiſe shewed vs the way to do, by the liberty themſelues haue taken to diſſent in ſome pointes from their predeceſſours.

And were it our turne, to declare and teach Logike and Metaphikſies, we should be forced to goe the way, of *matter*, and of *formes*, and of *priuations*, in ſuch ſort as Ariſtotle hath trodden it out to vs, in his workes of that ſtraine. But this is not our taske for the preſent; for no man that contemplateth nature as he aught, can chooſe but ſee that theſe notions are no more neceſſary, when we conſider the framing of the elements, then when we examine the making of compounded bodies: and therefore, theſe are to be ſett apart, as higher principles, and of an other ſtraine, then neede be made vſe of for the actuall compoſition of compounded thinges, and for the reſolution of them into their materiall ingredients, or to cauſe their particular motions; which are the ſubiects we now diſcourſe of.

Vpon this occaſion, I thinke it not amiſſe to touch, how the latter ſectatours, or rather pretenders of Ariſtotle, (for truly they haue not his way) haue introduced a modell of doctrine (or rather of ignorance) out of his wordes, which he neuer ſo much as dreamed of; howbeit they alleage textes out of him to confirme what they ſay, as Heretikes do out of ſcripture to prooue their aſſertions: for whereas he called certaine collections or poſitions of thinges, by certaine common names (as the art of Logike requireth) terming ſome of them *Qualities*, others *actions*, others *places*, or *habites*, or *relatiues*, or the like: theſe his latter followers, haue conceited that theſe names did not deſigne a concurrence of ſundry thinges, or a diuers diſpoſition of the partes of any thing, out of which ſome effect reſulted; which the vnderſtanding conſidering all together, hath expreſſed the notion of it by one name: but haue imagined, that euery one of theſe names had correſpondent vnto it, ſome reall poſitiue entity or thing, ſeperated (in its owne nature) from the maine thing or ſubſtance in which it was, and indifferent to any other ſubſtance; but in all vnto which it is linked, working ſtill that effect, which is to be expected from the nature of ſuch a *quality*, or *action*, &c. And thus, to the very negatiues of thinges, as to the names of pointes, lines, inſtantes, and the like, they haue imagined poſitiue Entities to correſpond: likewiſe, to the names of *actions*, *places*, and the like, they haue

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haue framed other Entities: as alſo to the names of *colours*, *ſoundes*, *taſtes*, *ſmels*, *touches*, and the reſt of the *ſenſible qualities*, they haue vnto euery one of them, allotted ſpeciall Entities; and generally to all qualities whatſoeuer. Whereas nothing is more euidēt, then that Ariſtotle meaned by *qualities* no other thing, but that diſpoſition of partes, which is proper to one body, and is not found in all: as you will plainely ſee, if you but examine, what *beauty*, *health*, *agility*, *ſcience*, and ſuch other qualities are; (for by that name he calleth them; and by ſuch examples, giueth vs to vnderſtand what he meaneth by the word *Quality*) the firſt of which is nothing elſe, but a compoſition of ſeuerall partes and colours, in due proportion to one an other: the next, but a due temper of the humours, and the being of euery part of the body, in the ſtate it should be: the third, but a due proportion of the ſpirits and ſtrength of the ſinnewes: and the laſt, but ordered Phantaſmes.

Now when theſe peruerters of Ariſtotle haue framed ſuch Entities, vnder that conception which nature hath attributed to ſubſtances, they do immediately vpon the nicke, with the ſame breath that deſcribed them as ſubſtances, deny them to be ſubſtances: and thus they confound the firſt apprehenſions of nature, by ſeeking learned and ſtrained definitions for plaine thinges. After which, they are faine to looke for glew and paſte, to ioyne theſe entities vnto the ſubſtance they accompany: which they find with the ſame facility, by imagining a new Entity, whoſe nature it is to do that which they haue neede of.

And this is the generall courſe of their Philoſophy; whoſe great ſubtility, and queint ſpeculations in enquiring how thinges do come to paſſe afford no better ſatisfaction then to ſay vpon euery occaſion, that there is an *Entity* which maketh it be ſo. As if you aske them, how *a wall is white, or blacke*? They will tell you, there is an *Entity* or *Quality*, whoſe eſſence is to be *whiteneſſe or blackeneſſe*, diffuſed through the wall. If you continue to aske, how doth whiteneſſe ſticke to the wall? They reply, that it is by meanes of an Entity called *Vnion*, whoſe nature it is actually to ioyne whiteneſſe and the wall together. And then if you enquire how it cometh to paſſe, that one white is like an other? They will as readily anſwere, that this is wrought by an other Entity, whoſe nature is to be *likeneſſe*, and it maketh one thing like an other. The conſideration of which doctrine, maketh me remember a ridiculous tale of a trewant ſchooleboyes latine: who vpon a time when he came home to ſee his frendes, being asked by his father, what was latine for *bread*? anſwered *breadibus*; and for *beere*? *beeribus*; and the like of all other thinges he asked him, adding only a termination in *Bus*, to the plaine English word of euery one of them: which his father perceiuing and (though ignorant of Latine) yet preſently apprehending, that the myſteries his ſonne had learned, deſerued not the expence of keeping him at ſchoole, bad him immediately putt of his *hoſibus* and *shooſibus*, and fall to his old trade of treading *Morteribus*. In like manner, theſe

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great Clerkes do as readily find a pretty Quality or moode, whereby to render the nature or cauſes of any effect in their eaſy Philoſophy, as this Boy did a *Bus* to ſtampe vpon any English word, and coyne it into his mockelatine.

But to be ſerious, as the weight of the matter requireth, lett theſe ſo peremptory pretenders of Ariſtotle, ſhew me but one text in him, where he admitteth any middle diſtinction (ſuch as thoſe moderne Philoſophers do, and muſt needes admitt, who maintaine the qualities we haue reiected) betwixt that which he calleth *Numericall*, and that which he calleth of *Reaſon*, or of *Notion*, or of *Definition*, (the firſt of which we may terme to be of, or *in thinges*; the other to be *in our heades*, or *diſcourſes*: or the one *Naturall*, the other *Logicall*:) and I will yield that they haue reaſon, and that I haue groſſely miſtaken what he hath written, and that I do not reach the depth of his ſenſe. But this they will neuer be able to do.

Beſides, the whole ſcope of his doctrine, and all his diſcourſes and intentions, are carryed throughout, and are built vpon the ſame foundations, that we haue layed for ours. Which being ſo, no body can quarrell with vs for Ariſtotles ſake; who as he was the greateſt Logician, and Metaphyſitian, and Vniuerſall ſcholler peraduenture that euer liued; and was ſo highly eſteemed, that the good turne which *Sylla* did the world in ſauing his workes, was thought to recompence his many outragious cruelties and tyranny; ſo his name muſt neuer be mentioned among ſchollers, but with reuerence, for his vnparalleled worth; and with gratitude for the large ſtocke of knowledge he hath enriched vs with. Yet withall we are to conſider, that ſince his raigne was but at the beginning of ſciences, he could not choſe but haue ſome defects and ſhorteneſſes, among his many great and admirable perfections.

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THE SECOND TREATISE; DECLARING, THE NATVRE AND OPERATIONS OF MANS SOVLE; OVT OF WHICH, THE IMMORTALITY OF REASONABLE SOVLES, IS CONVINCED.

Pro captu Lectoris, habent ſua fata libelli.

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THE PREFACE.

IT is now high time for vs to caſt an eye vpon the other leafe of our accounts: or peraduenture I may more properly ſay, to fall to the peruſall of our owne accountes: for hitherto, our time and paines haue beene taken vp, in examining and caſting the accountes of others: to the end, that from the foote and totall of them, we may driue on our owne the more ſmoothly. In ours then, we ſhall meete with a new Capitall; we ſhall diſcouer a new world, of a quite different ſtraine and nature from that which all this while we haue employed our ſelues about. We will enter into them, with taking a ſuruay of the great Maſter of all that large family, we haue ſo ſummarily viewed: I meane of Man, as he is Man: that is, not as he is ſubiect to thoſe lawes, whereby other bodies are gouerned (for therein he hath no præeminence, to raiſe him out of their throng:) but as he exceedeth the reſt of creatures, which are ſubiect to his managing: and as he ruleth ouer nature herſelfe, making her ſerue his deſignes; and ſubiecting her nobleſt powers, to his lawes; and as he is diſtinguished from all other creatures whatſoeuer. To the end we may diſcouer, whether that principle in him, from whence thoſe actions do proceede which are properly his, be but ſome refined compoſition, of the ſame kind we haue already treated of: or whether it deriueth its ſource and origine, from ſome higher ſpring and ſtocke, and be of a quite different nature.

Hauing then by our former Treatiſe maſtered the oppoſitions, which elſe would haue taken armes againſt vs, when we ſhould haue beene in the middeſt of our ædifice; and hauing cleared the obiections which lay in our way, from the peruerſe Qualities of the ſoules neighbours, the ſeuerall common wealthes of Bodies: we muſt now beginne with Dauid to gather together our Materialls; and to take a ſuruay of our owne prouiſions: that ſo we may proceed with Salomon, to the ſacred building of Gods

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temple. But before we goe about it, it will not be amisse, that we shew the reason, why we haue made our porch so great, and haue added so long an entry, that the house is not likely to haue thereunto a correspondent bulke: and when the necessity of my doing so, shall appeare, I hope my paines will meete with a fauourable censure, and receiue a faire admittance.

We proposed vnto our selues to shew that our soules are immortall: *whereupon, casting about to find the groundes of* immortality, *and discerning it to be a negatiue, we conceiued that we ought to beginne our search, with enquiring* What Mortality is; *and what be the causes of it. Which when we should haue discouered, and haue brought the soule to their teste, if we found they trēched not vpon her, nor any way concerned her condition, we might safely conclude, that of necessity she must be immortall. Looking then into the causes of mortality, we saw that all bodies round about vs were mortall: whence perceiuing that mortality extended it selfe as farre as corporeity, we found our selues obliged, if we would free the soule from that law, to shew that she is not corporeall. This could not be done without enquiring what corporeity was. Now it being a rule among Logitians, that a definition can not be good, vnlesse it comprehend and reach to euery particular of that which is defined; we perceiued it impossible to know compleatly, what* a Body is, *without taking a generall view of all those thinges, which we comprise vnder the name and meaning of* Bodies. *This is the cause, we spent so much time in the first Treatise: and I hope to good purpose; for there we found, that the nature of a Body, consisted in being made of partes: that all the differencies of bodies, are reduced to hauing more or lesse partes, in comparison to their substance, thus and thus ordered: and lastly, that all their operations, are nothing else but locall motion, which followeth naturally out of hauing partes. So as it appeareth euidently from hence, that if any thing haue a being, and yet haue no partes; it is not a body, but a substance of an other quality and condition: and consequently, if we can find the soules Being to be without partes, and that her operations, are no locall translation; we euidently conclude her to be an immateriall or spirituall substance.*

Peraduenture it may be obiected, that all this might haue beene done a much shorter way then we haue taken; and that we needed not haue branched our discourse, into so many particulars,

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nor haue driuen them ſo home, as we haue done: but that we might haue taken our firſt riſe from this ground, (which is as euident, as light of Reaſon can make it) that ſeeing we know biggeneſſe *and a* Body, *to be one and the ſame, as well in the notion as in the thing; it muſt of neceſsity follow, that what hath not partes, nor worketh, nor is wrought vpon by diuiſion,* is not a body. *I confeſſe, this obiection appeareth very reaſonable, and the conſideration of it weighed ſo much with me, as, were all men of a free iudgement, and not imbued with artificiall errours, I would for its ſake, haue ſaued my ſelfe a great deale of paines: but I find (as in the former Treatiſe I haue frequently complained of) that there is crept into the world a fanſy ſo contrary to this pregnant truth, and that it is ſo deepely ſettled in many mens minds (and not of the meaneſt note,) as all we haue ſaid, is peraduenture too litle to roote it out.*

If any that being ſatisfyed with the rationall maxime we euen now mentioned, and therefore hath not deemed it needefull, to employ his time in reading the former Treatiſe, should wish to know how this is come to paſſe, I shall here repreſent vnto him, the ſumme of what I haue more at large ſcattered in ſeuerall places of the former Treatiſe; and shall entreate him to conſider, how nature teacheth vs to call the proprieties of thinges whereby one is diſtinguished from an other, the Qualities *of thoſe thinges; and that according to the varieties of them, they haue diuers names ſuted out to diuers of them; ſome being called* Habites, *others* Powers; *and others by other names. Now what Ariſtotle, and the learned Grecians did meane by theſe thinges, is cleere by the examples they giue of them: they terme* Beauty *and* Health, Habites: *the diſpoſitions of our bodies to our bodily motions,* Powers; *as* ſtrength (*which is the good temper of the ſinewes*) *a* Power; *likewiſe* Agility, a Power; *ſo they vſe the names of the concoctiue, the nutritiue, the retentiue, the excretiue,* Power; *the health of the eyes, the eares, the noſethrills, &c: they call the* Powers *of ſeeing, of hearing, of ſmelling, &c: and the like of many others. But later Philoſophers, being very diſputatiue, and deſiring to ſeeme ignorant of nothing (or rather, to ſeeme to know more then any that are gone before them and to refine their conceptions) haue taken the notions, which by our firſt Maſters were ſett for common and confuſed explications of the natures, (to ſerue*

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for conueniency and ſuccinctenesſe of diſcourſe) to be truly and really particular Entities , or thinges of themſelues: and ſo haue filled their bookes , and the ſchooles , with vnexplicable opinions , out of which no account of nature can be giuen : and which is worſe , the way of ſearching on , is barred to others; and a miſchieuous error is growne into mens beliefes , that nothing can be knowne. By this meanes they haue choaked the moſt plaine and euident definition of a body *; bringing ſo many inſtances againſt it, that vnwary men are forced to deſert and deny the very firſt notions of nature and reaſon : for in truth , they turne all bodies into ſpirits , making (for example) heate , or cold , to be of it ſelfe indiuiſible , a thing by it ſelfe, whoſe nature is not conceiuable ; not the diſpoſition or proportion of the partes of that body which is ſaid to be hoat or cold ; but a reall thing , that hath a proper* Being *and nature peculiar to it ſelfe ; whereof they can render you no account : and ſo , may as well be againſt the notion of a body as not : for if light , the vertue of the loadeſtone , the power of ſeing , feeling &c, be thinges that worke without time , iu an inſtant ; if they be not the diſpoſitions of partes as partes , (whoſe nature is , to be more or leſſe , to be next or farre off , &c:) how can it be truly ſaid , that the notion of a* body , *is* to be of partes? *For if this be a true definition of a* body , *it followeth that all corporeall qualities and actions muſt likewiſe be ſome diſpoſition and order of partes as partes : and that what is not ſo , is no body , nor bodily quality or propriety.*

This then was it that obliged me to go ſo farre about, and to shew in common, how all thoſe effects which are ſo much admired in bodies , are , or may be made and continued by the ſole order of quantitatiue partes and locall motion : this hath forced vs to anatomiſe nature , and to beginne our diſſection , with what firſt occurreth vnto our ſenſe from a body. In doing which , out of the firſt and moſt ſimple notion of Biggeneſſe *or* Quantity , *we found out the prime diuiſion of* Bodies , *into* Rare *and* Denſe: *then finding them to be the Qualities of* diuiding *and of being* diuided *(that is , of* locall motion *) we gained knowledge of the common properties of* Grauity *and* Leuity:

from

from the combination of these, we retriued the foure first Qualities: *and by them,* the Elements. *When we had agreed how the Elements were made, wee examined how their action and composition, raiseth those* second qualities, *which are seene in all mixt bodies, and doe make their diuisions. Thence, proceeding into* the operations of life, *we resolued, they are composed and ordered meerely by the varieties of the former: nay, that* sense *and* fantasy *(the highest thinges we can discerne out of man) haue no other source, but are subiect to the lawes of partes, and of Rarity and Density; so that in the end we became assured of this important Maxime:* That nothing whatsoeuer we know to be a Body, can be exempted from the declared lawes, and orderly motions, of Bodies: *vnto which, lett vs adde two other positions, which fell also within our discouery: the first that it is constantly found in nature,* that none of the bodies we know, do moue themselues; but their motion must be founded in some thing without them: *the second,* that no body moueth an other, vnlesse it selfe be also moued: *and it will follow euidently out of them, (if they be of necessity and not preuaricable) that some other Principle beyond bodies, is required to be the roote and first ground of motion in them: as Mr. White hath most acutely aud solidely demonstrated, in that excellent worke, I haue so often cited in my former Treatise.* Dialog: 3°. Nodo 2°.

But it is time we should fall to our intended discourse, leauing this point settled by what we haue already said, that if we shew our soule, and her operations, to be not composed of partes, we also therein conclude, that she is a spirituall substance, and not a body. Which is our designe and intention in this Treatise.

And for this intent, we must looke vpon those actions of man, which are peculiarly his: and vpon those thinges which result out of them, and are called, Opera *or* labores hominum; *as houses, Townes, Tillage, Handicrafts, Armes, shippes, Commonwealthes, Armies, Bookes, and the like; in which great mens lifes and thoughts haue beene spent. In all these we find one generall thridde, to runne quite through them; and that all of them are composed of the same stuffe, and are built vpon the same foundation: which is, a long chaine of discourses, whereof euery little part or linke is that which schollers do call a* Syllogisme: *and* Syllogismes *we know are framed of* enuntiations; *and they of single or*

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vncompoſed apprehenſions. *All which are actions wrought by the vnderſtanding of a man. But beyond theſe, we can not proceede to any further ſubdiuiſion of partes, and containe our ſelues within the orbe* of humane Actions; *for ſimple apprehenſions, can not be further reſolued into other partes, beyond the degree of apprehenſions, and yet ſtill remaine actions peculiar to a man: ſo that we may be ſure, we ſhall haue left nothing out of enquiry, concerning* Mans actions *as he is* Man, *if we beginne with anatomizing his firſt bare apprehenſions; and ſo goe on by degrees, compounding them, till we come to faddome thoſe great and admirable machines of bookes and workes, which he (as I may ſay) weaueth out of his owne bowels; and the like of which, is done by no other creature whatſoeuer, vpon the face of our contemptible Earth.*

Theſe then (which are all compriſed vnder the names of Apprehenſions, *of* Enuntiations *or* Iudgements, *and of* Diſcourſes) *ſhall be the ſubiect of this ſecond Treatiſe: and in it, we will firſt conſider theſe operations in themſelues; which being done, we will endeauour to proue out of the nature and manner of performing them, that the ſoules vnto whom they belong, are* Immateriall *and* Immortall.

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THE SECOND TREATISE; DECLARING, THE NATVRE AND OPERATIONS OF MANS SOVLE.

THE FIRST CHAPTER.

Of ſimple Apprehenſions.

THAT we may duely vnderſtand, what a right Apprehenſion is, lett vs conſider the preeminence that a man who apprehendeth a thing rightly, hath ouer him who miſſeth of doing ſo. This latter can but roue wildely at the nature of the thing he apprendeth; and will neuer be able to draw any operation into act, out of the apprehenſion he hath framed of it. As for example: if a man be to worke vpon gold, and by reaſon of its reſemblance vnto braſſe, hath formed an apprehenſion of braſſe, inſteed of an apprehenſion of gold, and then (knowing that the action of fire, will reſolue braſſe into its leaſt partes, and ſeuer its moiſt from its dry ones) will go about to calcine gold in the ſame manner as he would do braſſe; he will ſoone find that he looſeth his labour; and that ordinary fire is not an adequate Agent to deſtroy the homogeneall nature, and to ſeuer the minute partes of that fixed mettall: all which happeneth, out of the wrong apprehenſion he hath made of gold. Whereas on the other ſide, he that apprehendeth a thing rigthly, if he pleaſeth to diſcourſe of what he apprehendeth, findeth in his apprehenſion all the partes and qualities, which are in the thing he diſcourſeth of: for example, if he apprehendeth rightly a knife, or a beetle, or a ſiuue, or any other thing whatſoeuer; in the *knife* he will find *hafte* and *blade*; the blade of iron, thicke on the backe, and thinne on the edge; tempered to be hard and tough; thus

1. What is a right apprehenſion of a thing.

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beaten, so ground, in such manner softened, thus quenched, and whatsoeuer else concerneth the Being or the making of a knife: and all this he draweth out of his notion or apprehension of a knife; which is, *that it is an instrument fitted to cutt such and such thinges, in such a manner*: for hence he findeth, that it hath an haft, fitt to hold it by in ones hand, to the end it may not hurt the hand, whiles it presseth vpon the knife; and that the blade is apt to slide in betwixt the partes of the thing which is to be cutt, by the motion of being pressed or drawne by the hand: and so he proceedeth on, descending to the qualities of both partes; and how they are to be ioyned, and held fast together. In the like manner, he discourseth of a beetle, of a siuue, or of whatsoeuer else cometh in his way. And he doth this, not only in such manufactures as are of mans inuention; but (if he be capable) he doth the like in beastes, in birdes, in trees, in herbes, in fishes, in fossiles, and in what creature soeuer he meeteth withall, within the whole extent of nature. He findeth what they are made for: and hauing discouered natures ayme in their production, he can instruct others, what partes and manner of generation they haue, or ought to haue: and if he that in this manner apprehendeth any thing rightly, hath a minde to worke vpon it, eyther to make it, or to vse and order it to some end of his owne; he is able by his right apprehension, to compare it vnto other thinges; to prepare what is any way fitting for the making of it; to apply it vnto what it will worke its effect vpon; and to conserue it from what may wrong or destroy it: so, if he haue framed a right apprehension of a siuue, he will not employ it in drawing water; if of a beetle, he will not go about to cutt with it: neyther will he offer, if he haue a due apprehension of a knife, to cutt stone or steele with it, but wood, or what is softer. He knoweth what will whette and maintaine the edge of it; and vnderstandeth what will blunt or breake it: In fine, he vseth it in such sort, as the knife it selfe (had it knowledge and will) would wish to be vsed; and moueth it in such a manner, as if it had power of motion, it would moue it selfe: he goeth about the making it, euen as nature would do, were it one of her plantes: and in a word, the knife in this apprehension made in the man, hath those causes, proprieties, and effects, which are naturall vnto it; and which nature would giue it, if it were made by her; and which are proportionable to those partes, causes, proprieties, and effects, that nature bestoweth on her children and creatures, according to their seuerall essences.

2. The very thing it selfe is truly in his vnderstanding who rightly apprehendeth it.

What then can we imagine, but that the very nature of a thing apprehended, is truly in the man, who doth apprehend it? And that to apprehend ought, is to haue the nature of that thing within ones selfe? And that man, by apprehending, doth become the thing apprehended; not by change of his nature vnto it, but by assumption of it vnto his?

Here peraduenture some will reply, that we presse our inference to farre: and will peremptorily deny the thinges reall being in our minde, when we make a true and full apprehension of it; accounting it sufficient for our

for our purpoſe, that ſome likeneſſe, or image of the thing be there; out of which, we may draw all theſe, whether contemplations, or workes, or diſpoſals of the thing. But by that time this obiection is throughly looked into, and that ſo much as they allow is duely examined, I beleeue we shall find our quarrell to be only about the word, not about the matter: and that indeede, both of vs, do meane the ſame, howbeit diuerſly conceiued: and that in ſubſtance their expreſſion, in what they graunt, importeth the ſame as ours doth: which, it is true, they firſt deny in wordes; but that may be, becauſe the thing is not by them rightly vnderſtood.

Lett vs then diſcuſſe the matter particularly. What is likeneſſe, but an imperfect vnity betweene a thing, and that which it is ſaid to be like vnto? If the likeneſſe be imperfect, it is more vnlike then it is like vnto it: and the liker it is, the more it is one with it; vntill at length, the growing likeneſſe may arriue to ſuch a perfection, and to ſuch a vnity with the thing it is like vnto, that then, it shall no longer be like, but is become wholy the ſame, with what formerly it had but a reſemblance of. For example, lett vs conſider, in what conſiſteth the likeneſſe vnto a man, of a picture drawne inblacke and white repreſenting a man: and we shall find, it is only in the proportions of the limbes and features; for the colours, the bulke, and all thinges elſe are vnlike; but the proportions are the very ſame, in a man and in a picture; yet that picture is but a likeneſſe, becauſe it wanteth biggeneſſe and colour: giue it them; and neuertheleſſe it will yet be but a likeneſſe, becauſe it wanteth all the dimenſions of corporeity or bulke, which are in a mans body: adde alſo thoſe to it; and ſtill it will be but a likeneſſe or repreſentation of a man, becauſe it wanteth the warmeth, the ſofteneſſe, and the other qualities of a liuing body, which belong to a man: but if you giue it all theſe, then it is no longer a likeneſſe or image of a liuing creature, but a liuing creature indeede; and if peraduenture this liuing creature do continue ſtill to be but the likeneſſe of a man, it is becauſe it wanteth ſome perfections or proprieties belonging to a man: and ſo in that regard, is vnlike a man: but if you allow it all thoſe, ſo that in nothing it be vnlike, then your taking away all vnlikeneſſe, taketh away likeneſſe too: and as before of dead, it became a liuing crearure, ſo now of an other liuing creature, it becometh a man, and is no longer like a mã. You ſee then plainely the reaſon, why that, which we call *a like thing*, is not *the ſame*; for in ſome part it is diſlike: but if the likeneſſe were complete in euery regard, then it were no longer to be called *like*, but the very thing it ſelf: and therefore we may conclude, that if the likeneſſe of a thing, which the obiection alloweth to be in our knowledge, do containe all that is in the thing knowne, then it is in truth, no more a likeneſſe, but the very knowne thing it ſelfe: and ſo what they graunt, amounteth to as much as we require; though att the firſt they go about to exclude it.

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3. The Apprehenſion of things cõming vnto vs by our ſenſes, are reſoluable into other more ſimple apprehenſions.

Hauing thus concluded, that when we apprehend any thing, that very thing is in vs; lett vs in the next place examine, how it cometh thither, and what it is there. Which we ſhall beſt do, by anatomiſing, and looking narrowly into the nature of ſuch apprehenſions, as we dayly make of thinges. It is true we ſaid euen now, that we can not diuide the actions of mans mind, further then into apprehenſions; and therefore we called them ſimple and vncompoſed: and with good reaſon; for if we reflect vpon the operations of our mind, we ſhall euidently perceiue, that our bare apprehenſions, and only they, are ſuch: but withall we muſt acknowledge, that all the apprehenſions we make of thinges coming vnto vs by our ſenſes, are compoſed of other more ſingle apprehenſions, and may be reſolued into them: all which are as it were the limbes and partes, that make vp and conſtitute the other totall one.

4. The apprehenſion of a *Being* is the moſt ſimple and *Baſis* of all the reſt.

Lett vs make vſe of our former example, and diſſect the apprehenſion we make of a knife: I find in my vnderſtanding that it is a thing ſo long, ſo broade, ſo sharpe, ſo heauy, of ſuch a colour, ſo moulded, ſo tempered &c, as is fitt to cutt withall. In this totall apprehenſion, I diſcouer three kindes of particular apprehenſions, euery one more ſimple and refined then the other. The higheſt of them, and the foundation vpon which the others are built, is the notion of *Being*: which is of ſo high, and of ſo abſtracted a nature, that we can not retriue wordes to expreſſe in what manner we conceiue it; but are faine to content our ſelues with the outward ſound of a word, by which, without diſcribing our owne, we ſtirre vp a like conception in an other: and that is the word *Is*; by which we intimate the *Being* of the thing we apprehend. And this notion can be in our minde, without inferring any other: and therefore is the ſimpleſt of all others: which of neceſſity, muſt imply it, and can not be without it, although it can be without them.

5. The apprehenſion of a *thing* is in next degree to that of *Being*, and it is the *Baſis* of all the ſubſequẽt ones.

Our next apprehenſion is of that which hath *Being*: and is expreſſed by the word *Thing*. This is not ſo ſimple as the former; for it is compoſed of it, and of what receiueth it; of *Being*, and of *what hath Being*: yet it is much ſimpler then the next degree of apprehenſions, which is cauſed in our mind by the great variety of thinges, that come hither through our ſenſes; and can be conceiued without any of them, though none of them can without it; for I can haue in me the notion of *a thing*, abſtracting from all accidents whatſoeuer; as of magnitude, of figure, of colour, of reſemblance, or the like: but I can not conceiue it to be long, or sharpe, or blew, &c, without allowing it firſt to be *ſomewhat* or *ſomething*, that is in ſuch ſort affected: ſo that the apprehenſion of a *thing*, or of that which *hath Being*, is the baſis of all our other ſubſequent apprehenſions; as the apprehenſion of *Being*, is the baſis of the apprehenſion of *a thing*: for had it not *Being*, it were not a *thing*; and were it not a *thing*, it could not be ſaid to be a *long thing* or *a sharpe thing*; nor indeede that it were *long or sharpe*: for to be ſo, doth include *Being*; and what hath *Being*, is a *Thing*. And thus we may obſerue, how the bulke of our apprehenſions is compoſed

is compoſed of ſomething aduentitious, and of ſomething formerly within vs, which is of a very different nature from all the others; and yet ſo fitted and neceſſary to them, that none of them can be without it, although it not only can be, but is beſt conceiued without relation to any of them.

6. The apprehenſion of things knowne to vs by our ſenſes, doth conſiſt in certaine reſpects betwixt too things.

We shall eaſily diſcerne, of how different a ſtraine this conception of *Being*, is from all others, that enter by our ſenſes, (as from the conceptions of colours, of ſoundes, and the like) if we but reflect vpon that act in vs, which maketh it; and then compare it with the others: for we shall find, that all they do conſiſt *in*, or *of* certaine reſpects betwixt two thinges; whereas this of *Being*, is an abſolute and ſimple conception of it ſelfe, without any relation to ought elſe; and can not be deſcribed or expreſſed with other wordes, or by comparing it to any other thing: only we are ſure, we vnderſtand and know what it is.

But to make this point the clearer, it will not be amiſſe to shew more particularly, wherein the other ſort of apprehenſions are different from this of *Being*; and how they conſiſt in certaine reſpects betweene differēt thinges, and are knowne only by thoſe reſpects: whereas this is knowne only in it ſelfe; abſtracting from all other thinges whatſoeuer. An example will do it beſt: when I apprehend the *whiteneſſe* in the wall, I may conſider how that white, is a thing which maketh ſuch an impreſſion vpon my fantaſy; and ſo accordingly, I know or expreſſe the nature of *white*, by a reſpect or proportion of the wall, to worke vpon my fantaſy. In like manner, if we take a notion that ariſeth out of what entereth immediately by our ſenſes, (for by ioyning ſuch alſo to the notion of *Being*, we make ordinary apprehenſions) we shall find the ſame nature: as when I conſider how this white wall, is *like* to an other white wall, the apprehenſion of *likeneſſe* that I haue in my mind, is nothing elſe, but a notion ariſing out of the impreſſion, which both thoſe walles together, do make vpon my fantaſy; ſo that, this apprehenſion is as the former, a certaine kind of reſpect or proportion of the two walles to my imagination: not as they make their impreſſions immediately vpon it, but as an other notion ariſeth, out of comparing the ſeuerall impreſſions, which thoſe two white walles made in it.

7. Reſpect or relation hath not really any formall being, but only in the apprehenſion of man.

Lett vs proceede a litle further, and examine what kind of thing that is, which we call *reſpect* or *proportion*, and where it reſideth. We shall find, that there is a very great difference, betweene what it is in it ſelfe, or in its owne eſſence, and what it is in the thinges that are reſpectiue: for in them, it is nothing elſe but the thinges, being plainely and bluntly what they are really in themſelues: as for example, two white walles to be like, is in them nothing elſe, but each of them to be white: and two quantities to be halfe and whole, is in them nothing elſe, but each quantity to be iuſt what it is. But *a reſpect* in its owne nature, is a kind of tye, compariſon, tending, or order, of one of thoſe thinges to an other; and is no where to be found in its formall ſubſiſtence, but in the apprehenſion of man: and

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therefore it can not be deſcribed by any ſimilitude, nor be expreſſed by any meanes, but (like *Being*) by the ſound of a word, which we are agreed vpon to ſtirre vp in vs ſuch a notion; for in the thinges, it is not ſuch a thing as our notion of it is: (which notion is that, which we vſe to expreſſe by prepoſitions and coniunctions, and which Ariſtotle and Logitians expreſſe in common, by the word πρὸς, or *ad*) and therefore there is nothing out of vs, to paint it by: as I could do *white*, or *ſquare*, or *round*, or the like; becauſe theſe haue a being in the thinges that are white, or ſquare &c, and conſequently they may be expreſſed by others of the like nature: but the *likeneſſe* that one white hath to an other, or the *reſpect* that eyther of them hath to mans imagination, is only in Man; who by comparing them, giueth birth to the nature and Being of *reſpect*.

8. That *Exiſtence* or *being* is the proper affectiō of man: and that mans ſoule is a comparing power.

Out of this diſcourſe, we may collect two ſingularities of man; which will much import vs, to take particular notice of: the one is, that *Being* or a *thing* (the formall notion of both which is meerely *Being*) is the proper affection of man; for euery particular thing is in him, by being (as I may ſay) grafted vpon the ſtocke of *Exiſtence* or of *Being*: and accordingly we ſee, that whatſoeuer we ſpeake of, we ſay it is *ſomething*: and whatſoeuer we conceiue, we giue it the nature of *a thing*; as when we haue ſaid, the wall is white, we frame *whiteneſſe* as *a thing*: ſo did we immediately before ſpeaking of *Reſpect*, we tooke *reſpect* as it were a *thing* and enquired, *where* it is: ſo that it is euident, that all the negotiation of our vnderſtanding, tradeth in all that is apprehended by it, as if they were *thinges*.

The other ſingularity we may obſerue in man is, that he is a *comparing power*; for all his particular knowledges, are nothing elſe but *reſpects* or *compariſons* betweene particular thinges: as for example, for a man to know heate, or cold &c, is to know, what effects fire or water &c, can worke vpon ſuch or ſuch bodies.

9. A thing by coming into the vnderſtanding of man, looſeth nothing of its owne peculiar nature.

Out of the firſt of theſe proprieties it followeth, that what affecteth a man, or maketh impreſſion vpon his vnderſtanding, doth not thereby looſe its owne peculiar nature, nor is it modifyed to the recipient; the contrary of which, we ſee happeneth perpetually in bodies: obſerue the ſuſtenance we take; which that it may be once part of our body, is firſt changed into a ſubſtance like our body, and ceaſeth being what it was: whē water or any liquid body is receiued into a veſſell, it looſeth its owne figure, and putteth on the figure of the veſſell it is in: if heate entereth into a body that is already hoat, that heate becometh thereby more heate; if into a cold body, it is conuerted into warmeth: and in like manner, all other corporeall thinges are accommodated to the qualities of the recipient; and in it, they looſe their owne proper termes and conſiſtences: but what cometh into the vnderſtanding of a man, is in ſuch ſort receiued by him or ioyned to him, that it ſtill retaineth its owne proper limitations and particular nature; notwithſtanding the aſsūption of it vnto

of it vnto him: for *Being* is ioyned to euery thing there; ſince (as we haue ſaid) it is by *Being* that any thing cometh thither: and conſequently this ſtocke of *Being*, maketh euery graft that is inoculated into it, *Be* what of its owne nature it is; for *Being* ioyned to an other notion, doth not change that notion, but maketh it be what it was before; ſithence if it should be changed, *Being* were not added to it: as for example, adde *Being* to the notion of *knife*, and it maketh a *knife*, or that notion, to *Be* a *knife*: and if after the addition, it doth not remaine *a knife*, it was not *Being*, that was added to a *knife*.

10. A multitude of things may be vnited in mans vnderſtãding without being mingled or confounded together.

Out of the later of the ſingularities proper to man, it followeth, that multitude of thinges may be vnited in him, without ſuffering any confuſion among themſelues; but euery one of them, will remaine with its proprieties, and diſtinct limitations: for ſo of neceſſity it muſt be, when that which vniteth them to him, is the comparing of them to ſomething beſides themſelues: which worke could not be performed, vnleſſe what is to be compared, do retaine exactly its owne nature, whereby the compariſon may be made: no more then one can weigh two quantities one againſt an other, vnleſſe he keepe aſunder what is in each ſcale, and keepe all other weights from mingling with them: and accordingly we ſee, that we can not compare blacke to white, or a horſe to an oxe, vnleſſe we take together, the properties by which blacke differeth from white, or an oxe from a horſe: and conſequently, they muſt remaine vnmingled and without confuſion, preciſely what in themſelues they are, and be different in the ſight of the comparer.

But indeede, if we looke well into the matter, we ſhall find, that ſetting a ſide the notion of *Exiſtence* or of *Being*, all our other notions are nothing elſe, but *compariſons* and *reſpects*: and that by the mediation of *reſpects*, the natures of all thinges are in vs: and that by the varying of them, we multiply our notions: which in their firſt diuiſion, that reduceth their ſeuerall kindes into generall heades, do encreaſe into the tenne famous tribes, that Logitians call *Predicaments*: and they do comprehend vnder them, all the particular notions that man hath, or can haue, according to the courſe of knowledge in this life. Of which *Predicaments* the ſeuen laſt are ſo manifeſtly reſpectiue, that all men acknowledge them to be ſo. *Subſtance* we haue already shewed to haue a reſpect vnto *Being*. *Quantity* we proued in the firſt Chapter of the former Treatiſe of the nature and of the operation of Bodies, to conſiſt in a reſpect vnto partes. *Quality* is diuided into foure branches: whereof *Power* is clearely a reſpect to that ouer which it hath power, or from which it may ſuffer. *Habite* is a reſpect to the ſubſtance wherein it is; as being the property by which it is well or ill, conueniently or inconueniently affected, in regard of its owne nature; as you may obſerue in health, or ſickneſſe, or the like. The *paſſible Qualities* are thoſe which we haue explicated, in diſcourſing of the Elements and of Mixtes; and whoſe natures we haue there shewed do conſiſt in reſpects of acting or of ſuffering. *Figure* or

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shape (which is the last branch of the diuision of the Predicament of Quality) is nothing else, but a certaine disposition of one part of a body to an other. And so you see, how all the tenne *Predicaments* do consist purely in diuersity of *Respects*: and by consequence, all our conceites and notions (excepting that of *Being*, which is the stocke, vpon which all the rest are grafted) are nothing else, but various respects; since all of them whatsoeuer, are compriſed vnder those generall heades. Concerning which, we shall not neede to dilate ourselues any further; seeing they are to be found in Aristotle, and in his Commentators, largely discourſed of.

II. Of abstracted and concrete termes.

In the next place, lett vs obserue, how our vnderstanding behaueth it selfe, in considering and in apprehending these respects. We haue already declared, that the variety of our notions, doth arise out of the respects which diuers thinges haue to one an other: hence will follow, that of the same thing, we may haue various notions: for comparing it to different thinges, we shall meete with different respects betweene them; and consequently, we shall consider the same thing, vnder different notions: as when we consider an apple, vnder the notions of greeneneſſe, of sweetneſſe, of roundeneſſe, of mellowneſſe &c: in such sort, as we haue amply declared in the first Treatise, and therefore neede not here enlarge ourselues any further vpon this particular. Now these notions are so absolutely seuered one from an other, and euery one of them hath such a completeneſſe within it selfe, that we may vse any one of them, without meddling at all with any of the others. And this we do two seuerall wayes: the one, when our māner of apprehension determineth vs to one precise notion, which is so summed vp within it selfe, as it not only abstracteth from all other notions, but also quite excludeth them, and admitteth no society with them. The other way is, when we consider a thing vnder a determinate notion, yet we do it in such a manner, that although we abstract from all other notions, neuertheleſſe we do so, rather by neglecting then by excluding them: and euen in the manner of our expreſſion of it, we insinuate that there are other notions (without specifying what) belonging vnto it.

Of the first kind of notions, are whiteneſſe, weight, heate, and such like, (whose names are called *abstracted termes*) which although they arise out of our comparing of the thinges that are white, heauy, hoat, &c: to our fantasy, or to other thinges; yet these notions are so precise, and shutt vp within themselues, that they absolutely exclude all others, (as of long, short, square, rough, sharpe, or whatsoeuer else) which may in the thinges accompany the whiteneſſe, weight, heate, &c, that our consideration is then busied only withall. Of the second kind of abstracted notions, are white, heauy, hoat &c (whose names, expreſſing them, are called *concrete termes:*) which although they cause in vs no other apprehensions then of whiteneſſe, of weight, of heate &c: yet they are not so rigorously paled in, as the others are, from admitting society with any besides;

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beſides; but do imply tacitely, that the thing which is white, heauy, hoat &c: hath beſides that, ſome other conſideration belonging vnto it (whatſoeuer it be) which is not expreſſed.

Now in this later abſtraction, it happeneth ſometimes, that the notion expreſſed, hath but an accidentall connexion with the other notions, that are in the thing vnexpreſſed: as for example; it is meerely accidentall to the white wall as it is *white*, to be high or lowe, of ſtone, of plaſter, or the like. But otherwhiles, the expreſſed notion is ſo eſſentiall to the concealed ones, that they can not be without it: as when we apprehend a clouen foote; although this apprehenſion do abſtract from all other notions beſides *clouenfootedneſſe* (if ſo I may ſay) yet, (as aboue we haue declared) it is in ſuch a manner, that it implyeth other conſiderations, not yet expreſſed, in that clouen foote: among which, ſome may be of that nature, that they can not haue a Being without preſuppoſing clouen-footedneſſe; but others may be meerely accidentall to that notion: as (for inſtance ſake) lett one be, *that the foote is clouen into three partes*; and lett an other be, *that it is blacke or hairy*; of theſe, this later notion of *blacke or hairy*, is of the firſt kind of abſtractions, which we ſaid had but an accidentall connexion with that which comprehended them without expreſſing them: for other thinges beſides the clouen foote, may be blacke or hairy; in ſuch ſort as height or lowneſſe, to be of ſtone or of plaſter, may belong vnto other ſtructures beſides the white wall: but to be *clouen footed into three partes*, doth ſo neceſſarily depend of being clouen footed in generall, (which implyeth this particular) and ſo directly includeth it, as it can not ſubſiſt without *clouenfootedneſſe*: for though we may conceiue a foote to be clouen, without determining in our apprehenſion, into how many toes it is clouen; yet we can not conceiue it to haue three, foure, or fiue toes, without apprehending it to be clouen: ſo that in ſuch like apprehenſions, the notion which is expreſſed, is ſo eſſentiall to the notion that is concealed and added vnto it, as the concealed one can not be conceiued without the expreſſed one; and whenſoeuer it is mentioned, the other is neceſſarily alſo brought in, and affirmed with it.

12. Of vniuerſal notions.

Now, ſome of theſe later kindes of notions, (in which what is expreſſed is eſſentiall to what is concealed) may be of ſuch a nature, as to be capable of receiuing the addition of ſundry other notions, ſo repugnãt vnto one an other, that they can not agree together in one ſubiect; and yet that generall notion, without determining any of the others, be indifferent to the contrary additions that include it, and belong as much to any one, as to any other of them: and ſo conſequently, whatſoeuer may be affirmed, and is true, of the primary notion, may as well be affirmed, and is as true, of the ſeuerall particulars, ariſing out of the repugnant additions. Such a notion, Logitians terme an *Vniuerſal* one: that is, one that reacheth indifferently and equally to all the particulars compriſed vnder it. As for example: to the notion of a liuing creature, may be added the notions of

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Reasonable and *vnreasonable*: which first notion, when it is barely expressed, it determineth no one of the two secondary notions, more then it doth the other; but is alike indifferent to eyther; and whatsoeuer belongeth to a liuing creature, belongeth entirely both to a man and to a beast: yet no one thing, can be both *reasonable* and *vnreasonable*. In like manner when I say, *a man is a discursiue creature*; vnder this word *man*, there lyeth a notion, by which may be signifyed any particular man, as Thomas, Iohn, William, &c: though of it selfe, it determine no one man whatsoeuer: and consequently, euery one of these particular men, must be allowed to be a discursiue creature, because the being such, belongeth vnto the notion of *man*, and that notion vnto all the particulars of Thomas, Iohn, Willian, &c: and yet no particular man can be both Thomas and Iohn, or Iohn and Willian, &c.

In this kinde of notion, we may obserue yet one propriety more: which is, that of it selfe, and in its common terme, it doth not cause ones thought to range vnto seuerall obiects; nor doth it imply that there are many particulars compriſed vnder it: yet if there be neuer so many, that conceite will fitt them euery one; and if there be but one, still it will be no lesse accommodated to that one. As for example: He that maketh a right apprehension of a *sunne*, doth not by that conception determine, whether there be many sunnes or but one: and if euery one of the starres which we call fixed) be sunnes to other earthes, it fitteth them all; and if here be no other sunne, then that which shineth to vs, it is satisfyed and taken vp with that: so likewise; before the production of Eue, the notion of a *man* was as fully taken vp by Adam alone, as it is now by his numerous progeny that filleth the world: nor doth our vnderstanding, when that terme is pronunced, consider (out of the force of the terme) whether there be many men, or only one.

13. Of apprehending a multitude vnder one notion.

An other propriety in mans apprehension not much vnlike to this, is, that he is able to compriſe a multitude in one indiuisible notion; and yet, that notion expresse the multiplicity of what it containeth: as we see in numbers, where the indiuisible conception of *tenne*, *a hundred*, *a thousand*, &c, doth plainely expresse the subiect to be many; and yet that notion of the nũber bindeth thẽ vp (as I may say) into one bundle, that in it selfe admitteth no diuision, nor will permitt that the least part be taken from it; for if it be, the whole bundle is destroyed and vanisheth: as when I take *tenne*, if one be diminished from it, it is no longer *tenne*, but *nine*. It fareth in like manner with the conceptions we frame of *All*, and *Euery one*, as it doth with numbers; for if but one be deficient, it is but a part, and not *all*, or *euery one*: so that these notions do indiuisibily terminate a multitude. And like to this notion, is the name or terme *whole*, in respect of thinges which as yet haue not diuision, but are capable of being diuided; for it is so rigorous, that if the least atome or thought be wanting, it is no longer the *whole*, but only a part.

And this is as much as at present appeareth vnto me needefull to be a conclusion

ſaid, concerning ſingle apprehenſions: vnleſſe I be permitted to adde for a concluſion, this litle note (which peraduenture might haue beene more properly ſett downe in an other place where we diſcourſed of *Being* but, that it occurred not then to me) that apprehenſion being rooted in the nature of *Being*, the power of it ſpreadeth it ſelfe as farre as the extent of *Being*: and conſequently reacheth to all thinges whatſoeuer; for, whatſoeuer is a *thing*; hath *Being* and that vnto which *Being* doth not reach, is nothing: nay, it is not limited there, but graſpeth euen at *nothing*, and aymeth to make a notion of it, and planteth its generation, by multiplying it ſelfe by negations of whatſoeuer is. Hence we haue the notions of deafeneſſe, of dumbeneſſe, of blindneſſe, of lameneſſe, of baldeneſſe, of death, of ſinne, and of all euills whatſoeuer, by the want of ſuch goods, as are ſenſible vnto vs.

14. The power of the vnderſtanding reacheth as farre as the extent of *being*.

THE SECOND CHAPTER.

Of thinking and knowing.

HAuing thus declared the nature of ſingle apprehenſions, the methode we haue preſcribed ourſelues, requireth that we examine in the next place, what effect the ioyning of them together may haue; for from thence do ſpring *Enunciations* or *Iudgements*; which are in the next ranke after ſimple apprehenſions, and are the materials whereof *diſcourſes* re immediately framed: as when of the two apprehenſions of *knife* and of *sharpe*, we make this enunciation, *the knife is sharpe*. In this enquiry the firſt thing that occurreth vnto vs, is to conſider, in what manner two differing ſimple apprehenſions, do become ioyned to one an other: and we ſhall find, that they are not tyed together like ſeuerall diſtinct thinges in one bundle, or like ſtones in a heape, where all that are cõpriſed vnder one multitude, are yet circumſcribed within their owne limits, and thereby are wholy diſtinguiſhed from each other; but that they are as it were grafted vpon one ſtocke; which being common to both, giueth the ſame life to both; and ſo becoming one with each of them, maketh them be one and the ſame thing betweene themſelues. And this is the notion of *Being* or *Exiſtence*, in the ſubiect we ſpeake of: which (as we haue already ſhewed) is the Baſis and foundation of all other apprehenſions; and by being common and indifferent to all, is the fitteſt glew to vnite thoſe that are capable of ſuch coniunction: and accordingly we ſee, that moſt of our ſpeech runneth vpon this ſtraine, that *this is that*, or *doth that* (which is as much to ſay as *is doing that*) that *Socrates is a man*, or that *Socrates runneth*, (which ſignifyeth, *is running*) and the like: and ſince our ſpeech proceedeth from the conceptions of our mind; it is cleare, that as the wordes which expreſſe *Being* or *Exiſtence*, do ioyne

1. How a iudgement is made by the vnderſtanding.

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together the other wordes that we vſe, (or at leaſt, the greateſt part of them) ſo likewiſe in our mind the apprehenſion of *Being*, is the glew that ioyneth our apprehenſions correſponding to our wordes.

2. That two or more apprehenſions are identifyed in the ſoule by vniting them in the ſtock of *being*.

All which will appeare to be ſaid with great reaſon, if we reflect vpon it; for when diuerſe apprehenſions may be thus ioyned together, it is indeed, that one and the ſame thing affecting vs ſeuerall wayes and under different conſiderations; thoſe different impreſſions do begett different apprehenſions in vs: and ſo, till we examine the matter, euery one of them ſeemeth to be a different thing: but when we trace theſe ſtreames vp to the fountaine head, we diſcerne that all of them do belong to one and the ſame thing; and that by being in that thing, they are among themſelues the very ſame thing, howeuer they affect vs variouſly; and therefore may truly be ſaid to be one, as indeed they are: and conſequently, nothing is more fitt to ioyne together in our mind thoſe different apprehenſions, then the apprehenſion of *Being*; which maketh vs apprehend as one thing, thoſe notions which really, and in the thing it ſelfe, are but one; as we haue often touched, both in the former Treatiſe, and lately in this: for this is the way to ioyne thinges in the mind intelligently, and according to the proper nature of the mind; which receiuing impreſſions from thinges exiſtent, ought to conſider thoſe impreſſions as they flow from the very thinges, and not as they are in the mind it ſelfe; and by mediation of thoſe impreſſions, muſt take a ſuruay of the thinges themſelues; and not ſtay at the intellectuall impreſſions they make in her: and conſequently, muſt apprehend thoſe thinges to be one in themſelues, (although in vs they be not ſo) according to the courſe of our originall and legitimate apprehenſions of thinges; which is, as they are exiſtent; that is, as they are in their owne nature, and in themſelues; and not according to the diſcourſes and ſecondary apprehenſions we make of the images we find of them in our mind. And thus thinges are rightly ioyned by apprehenſion; without caution in which particular, we ſhall runne into great errors in our diſcourſe: for if we be not very carefull herein, we are apt to miſtake the vſe of the impreſſions we receiue from thinges, and to ground our iudgements concerning them, according to what we find of them in our mind, and not according to what they are in themſelues: which two ſeuerall conſiderations, haue quite different faces; although (it is true) thoſe impreſſions are made by the thinges, and are the only meanes by which we may rightly iudge of them: prouided, that we conſider them as they are in the thinges, and not as they are in vs.

Now this coniunction of apprehenſions, by the mediation and the glew of *Being*, is the moſt naturall and fitting, not only in regard of the thinges, but euen in regard of vs: for (as we haue already shewed) it is of all others the moſt common and vniuerſall, the moſt ſimple or vncompoſed, and the moſt naturall and deepeſt rooted in man: out of all which, it is euident, that this vnion of apprehenſions by the meanes of *Being*, is in truth

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in truth an Identification of them: for Vnity being a negation of multiplicity, it followeth, that what is one, is the same: and this identification is truly and naturally expressed by saying, that *the one is the other.*

But insisting a litle further vpon this consideration, how different apprehensions become ioyned and vnited together, by the notion of *Being*; we may obserue that this happeneth, not only to two single ones, but to more; according as more then two, may belong vnto one thing: and it may so fall out, that more then one, be on eyther side the common ligament. Thus when we say, A *Man is a discoursiue creature*; or *a Rationall soule, is an immortall substance*, the two apprehensions, of *discoursiue*, and of *creature*, are ioyned together in a third of *Man*, by the tye of one *Being*: and the two apprehensions of *Immortall*, and of *Substance*, are vnited to the two others of *Rationall* and of *Soule*, likewise by the ligament of one single *Being*. Euident it is then, that the extremes are vnired by one *Being*: but how the two apprehensions that are ranked together on the same side of the ligament (as in our former examples, the apprehensions of *discoursiue* and of *creature*, of *rationall* and of *Soule*, of *Immortall* and of *substance*) are betweene themselues ioyned to one an other, is not so easy to expresse. It is cleare, that it is not done by meere conglobation; for we may obserue, that they do belong, or are apprehended to belong, vnto the same thing; and the very wordes that expresse them, do intimate so much, by one of them being an adiectiue; which sheweth, they are not two thinges; for if they were, they would require two substantiues to describe them: and consequently it followeth that one of them must needes appertaine to the other: and so both of them make but one thing. 3. How the notiõs of a substantiue and an adiectiue, are vnited in the soule, by the common stocke of *being*.

And there is no doubt, but in the inward apprehension, there is a variety correspondent to the variety of wordes which expresse it; since all variety of wordes that is made by intention, resulteth out of some such variety of apprehensions. Therefore, since the wordes do import, that the thinges haue a dependance the one of the other, we can not doubt, but that our apprehensions haue so too: which will be conceiued best, by looking into the act of our mind, when it frameth such variety of apprehensions belonging to one thing, correspondent to the variety in wordes of an *adiectiue* glewed vnto his *substantiue*; and attending heedfully to what we meane, when we speake so. The Hebrewes do expresse this vnion, or comprising of two different apprehensions vnder one notion, by putting in the genitiue case, the word which expresseth one of them, (much like the rule in *Lillies* grammar, that when two substantiues come together, if they belong to the same thing, the one is putt in the genitiue case.) As when in the scripture we meete with these wordes, *the iudge of vniustice, the spence of wickednesse, the man of sinne*, or *of death*; which in our phrase of speaking, do signify an vniust iudge, a wicked spence, and a sinnefull or dead man. In which it is euident, that as well the manner of vnderstanding, as of speaking, taketh each paire of

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theſe notions to belong vnto one thing; that is, to haue both of them, one and the ſame *Exiſtence*, although there interuene not the formall expreſſion of their being one. Thus we ſee, how one *Being* ſerueth two different wayes to ioyne and vnite ſeuerall apprehenſions: and if we will examine all the negotiations of our vnderſtanding, we ſhall hardly find any notions ſo farre diſtant, but may be brought together, eyther by the one of theſe wayes, or by the other.

4. That a ſettled iudgement becometh a part of our ſoule.

But this compoſition and ioyning of ſeuerall apprehenſions by the glew of *Being*, is not ſufficient to make vs deeme a thing to be really ſuch, as their vnion painteth in the mind, or as the wordes ſo tyed together do expreſſe in ſpeach. Well may it cauſe vs to thinke of the thing; but to thinke, or to deeme it ſuch an one (which word of *deeming*, we ſhall be obliged henceforward to vſe frequently, becauſe the word *thinking* is ſubiect to equiuocation) requireth the addition of ſomething more, then barely this compoſition of apprehenſions; which vnleſſe they be kept ſtraight by ſome leuell, may as well ſwarue from the ſubiect, as make a true picture of it. Here then we are to examine, what it is that maketh vs thinke any thing to be ſuch as we apprehend it: this we are ſure of, that when we do ſo, our actions which proceede vpon reaſon, and which haue relation to that thing, are gouerned and ſteered in euery circumſtance, iuſt as if the thing were truly ſo: as for example, if a man do really deeme the weather to be cold, or that his body is diſtempered, he putteth on warmer clothes, or taketh phyſike; although peraduenture he is miſtaken in both: for his deeming them to be ſo, maketh him demeane himſelfe in ſuch ſort, as if really they were ſo. It is then euident, that by ſuch thinking or deeming, the nature conceiued, is made an actiue principle in vs: vnto which if we adde, that all the knowledge we haue of our ſoule, is no more, but that it is an *actiue force* in vs, it ſeemeth, that a thing, by hauing apprehenſions made of it in our mind, and by being really thought to be agreable to ſuch apprehenſions, becometh (as it were) a part or affection of our ſoule, and one thing with it. And this peraduenture is the cauſe, why an vnderſtanding man can not eaſily leaue an opinion once deepely rooted in him; but doth wreſtle and ſtriue againſt all arguments that would force him from it, as if a part of his ſoule or vnderſtanding were to be torne from him: in ſuch manner as a beaſt will cry and ſtruggle to ſaue his body, from hauing any of his limbes diſioynted or pulled in pieces.

5. How the Soule commeth to deeme or ſettle a iudgement.

But this obſeruing the effect which followeth of our deeming a thing to be thus or ſo, is not ſufficient to informe vs, what it is that cauſeth that deeming. We muſt therefore take the matter a litle higher, and looke into its immediate principles: and there we ſhall find, that it is the knowing of what we ſay to be true, and the aſſurance, that the thinges are as we deeme them, which quieteth our ſoule, and maketh it conſent vnto them, and proceede to action vpon that conſent. Now this knowledge, is the moſt eminent part of deeming; and of all our acquiſitions, is the moſt inſeparable from vs; and indeed in rigour, it is abſolutely

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absolutely inseparable by direct meanes; howeuer peraduenture by indirect meanes it may be seperated.

Let vs then consider how we attaine vnto it, and how sometimes we faile in the purchase of it; and what degrees of assurance or of probability there are betweene it and errour. To this intent, we may obserue that the greatest assurance, and the most eminent knowledge we can haue of any thing, is of such Propositions, as in the schooles are called *Identicall*; as if one should say, *Iohn is Iohn*, or *a man is a man:* for the truth of these propositions is so euident and cleare, as it is impossible any man should doubt of them, if he vnderstand what he saith: and if we should meete with one that were not satisfyed of the verity of them, we would not go about to proue them to him, but would only apply ourselues to make him reflect vpon the wordes he speaketh, without vsing any further industry to gaine his assent therevnto: which is a manifest signe, that in such propositions, the apprehending or vnderstanding them, is the same thing as to know them and to consent vnto them: or at the least, that they are so necessarily conioyned, as the one followeth immediately out of the other, without needing any other causes to promote this effect, more then that a man be disposed, and willing to see the truth: so as we may conclude, that to vnderstand a proposition which openly carrieth its euidence with it, is to knew it. And by the same reason, although the euidence of a proposition, should not at the first sight be presently obuious vnto vs, yet with vnfolding and explicating of it, we come at length to discerne it; then likewise the apprehending of it, is the knowing of it.

We must therefore enquire, what it is that causeth this euidence: and to that purpose, reflecting vpon those instances we haue giuen of *Identicall propositions*, we may in them obserue, that euidence ariseth out of the plaine Identification of the extremes that are affirmed of one an other; so that, in what proposition soeuer, the Identification of the extremes is plaine, the truth of it is euident vnto vs, and our minde is satisfyed and at quiet; as being assured that it knoweth it to be so as the wordes say it. Now all affirmatiue propositions do by the forme of them import an Identification of their extremes, (for they all agree in saying *This is that*) yet they are not all alike in the euidence of their Identification: for in some it sheweth it selfe plainely, without needing any further helpe to discouer it; and those are without any more adoe knowne of themselues, as such *Identicall* sayings, we euen now gaue for examples: others require a iourney somewhat further about to shew their Identification; which if it be not so hidden, but that it may in the end be discouered and brought to light, as soone as that is done, the knowledge settled by them in the soule, is certaine and satisfactory as well as the other: but if it be so obscure, that we can not display the Identification of it, then our mind suspendeth his assent, and is vnquiet about it, and doubteth of the truth

of it: in some propositions, whiles he searcheth and enquireth after the Identification of their extremes; peraduenture he discerneth, that it is impossible there should be any betweene them; and then on the other side, he is satisfyed of the falsity of them: for if a proposition be affirmatiue, it must necessarily be a false one, if there be no Identification betweene the extremes of it.

By this discourse, we haue found two sortes of propositions, which begett knowledge in vs. The one, where the Identification of the extremes, is of it selfe so manifest, that when they are but explicated, it needeth no further proofe. The other, where though in truth they be Identified, yet the Identification appeareth not so cleare, but that some discourse is required to satisfy the vnderstanding therein. Of the first kind, are such propositions as do make one of the extremes the definition of the other whereof it is affirmed: as when we say, *a man is a reasonable creature*; which is so euident, if we vnderstand what is meaned by a *Man*, and what by *a reasonable creature*, as it needeth no further proofe to make vs know it: and knowledge is begotten in vs, not only by a perfect Identification of the extremes, but as well by an imperfect one: as when what is said of an other, is but part of its definition; for example, if one should say, *a man is a creature*, no body that knoweth him to be a rationall creature, (which is his complete definition) could doubt of his being a creature; because that the being *a creature*, is partly identifyed to being *a rationall creature*. In like manner, this obuious euidence of *Identification*, appeareth as well where a complete diuision of a thing is affirmed of the other extreme, as where that affirmation is made by the totall or partiall definition of it: as when we say, number is euen or odde: an enuntiation is true or false, and the like: where, because what is said, compriseth the differences of the thing whereof it is said, it is plaine that one of them must needes be that whereof we speake.

Peraduenture some may expect, that we should giue *Identicall propositions* (among others) for examples of this plaine euidence: but because they bring no acquisition of new knowledge vnto the soule, (the doing of which, and the reflecting vpon the manner, is the scope of this Chapter) I lett them passe without any further mention, vpon this occasion hauing produced them once before, only to shew by an vndenyable example, what it is that maketh our soule consent vnto an enuntiation, and how knowledge is begotten in her, that we might afterwardes apply the force of it to other propositions.

Lett vs therefore proceed to the second sort of propositions, which require some discourse, to proue the Identification of their extremes. Now the scope of such discourse is, by comparing them vnto some other third thing, to shew their Identification between themselues; for it sheweth, that each of them a part is identifyed with that new subiect it bringeth in: and then our vnderstanding is satisfyed of ther identity, and our soule is secure of that knowledge it thus acquireth, as well as it is of that which resulteth out of those propositions,

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ſitions, which beare their euidence in their firſt aſpect.

This negotiation of the vnderſtanding to diſcouer the truth of propoſitions, when it is ſomewhat hidden, (which we call *diſcourſe*) as it is one of the chiefeſt and nobleſt actions of the ſoule, ſo doth it challenge a very heedefull inſpection into it: and therefore we will allow it a peculiar Chapter by it ſelfe, to explicate the nature and particularities of it. But this litle we now haue ſaid concerning it, is ſufficient for this place; where all we ayme at is to proue (and I conceiue we haue done it very fully) that when *Identity* betweene two or more thinges, preſenteth it ſelfe to our vnderſtanding, it maketh and forceth knowledge in our ſoule.

Whence it is manifeſt, that the ſame power or ſoule, which in a ſingle apprehenſion is poſſeſſed with the *Entity* or *Vnity* of it, is that very power or ſoule, which applyed to an *Enunciation*, knoweth or deemeth; ſince *knowing* is nothing elſe, but the apprehending of manifeſt Identity in the extremes of a propoſition, or an effect immediately conſequent out of it, in the ſoule that applyeth it ſelfe to apprehend that Identity. Which apprehenſion is made, eyther by the force of the extremes, applyed immediately to one an other, or elſe by the application of them to ſome other thing: which peraduenture may require yet a further application vnto new apprehenſions, to make the Identity betweene the firſt extremes appeare euidently.

6. How opinion is begotten in the vnderſtanding.

Now, as when *Identity* truly appeareth, it maketh euidence to our vnderſtanding, and begetteth aſſured knowledge in our ſoule; ſo, when there is only an apparent Identity, but not a reall one, it happeneth that the vnderſtanding is quieted without euidence; and our ſoule is fraught with a wrong or ſlight beliefe, inſteed of certaine knowledge: as for example, it is for the moſt part true, that what wiſe men affirme, is ſo as they ſay; but becauſe wiſe men are but men (and conſequently not infaillible) it may happen that in ſome one thing, the wiſeſt men that are may miſſe, though in moſt and generally ſpeaking, they hitt right. Now if any body in a particular occaſion, ſhould (without examining the matter) take this propoſitiõ rigorouſly and peremptorily, *that what wiſe men affirme is true*; and ſhould there vpon ſubſume with euidence, *that wiſe men ſay ſuch a particular thing*, and ſhould there vpon proceede to beleeue it; in this caſe he may be deceiued, becauſe the firſt propoſition is not verily, but only ſeemingly euident.

And this is the manner how that kind of deeming, which is eyther oppoſed, or inferiour to knowledge, is bred in vs: to witt, when eyther through temerity, in ſuch caſes where we may, and it is iuſt we ſhould examine all particulars ſo carefully, that no equiuocation or miſtake in any part of them, be admitted to paſſe vpon vs for a truth, and yet we do not: or elſe, through the limitedneſſe and imperfection of our nature, when the minuteneſſe and variety of petty circumſtances in a buſineſſe is ſuch, as we can nor enter into an exact examination of all that belongeth to that matter, (for if we ſhould exactly diſcuſſe euery ſlight

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particular, we should neuer gett through any thing of moment) we settle our vnderstanding vpon groundes, that are not sufficient to moue and determine it. Now in some of these cases, (and particularly in the later) it may happen, that the vnderstanding it selfe is aware, that it neyther hath discouered, nor can discouer euidence enough , to settle its assent with absolute assurance: and then it iudgeth the beliefe it affordeth vnto such a proposition, to be but probable; and insteed of knowledge, hath but *opinion* concerning it. Which *opinion* appeareth to it more or lesse probable , according as the motiues it relyeth on, are stronger or weaker.

7. How faith is begotten in the vnderstanding.

There remaineth yet an other kind of deeming for vs to speake of; which though it euer faile of euidence , yet sometimes it is better then opinion, for sometimes it bringeth certitude with it. This we call *faith*; and it is bred in this sort : when we meete with a man, who knoweth something which we do not, if withall we be perswaded that he doth not, nor will not tell a lye; we then beleeue what he saith of that thing to be true: now according to the perswasion we haue of his knowledge and veracity, our beliefe is strong, or mingled with doubt : so that if we haue absolute assurance and certainety, that he knoweth the truth and will not lye, then we may be assured, that the faith which we yield to what he sayth, is certaine as well as euident knowledge is certaine, and admitteth no comparison with opinion, be it neuer so probable : but so it may happen, that we may be certainely assured that a man doth know the truth of what he speaketh of, and that he will not lye in reporting it to vs: for seeing no man is wicked without a cause; and that to tell a lye in a serious matter, is a great wickednesse; if once we come to be certaine that he hath no cause, (as it may fall out we may) then it followeth, that we are assured of the thing which he reporteth to vs.

Yet still such faith falleth short of the euidence of knowledge in this regard, that its euidence sticketh one degree on this side the thing it selfe: and at the push, in such a case we see but with an others eyes; and consequently, if any opposition do arise against our thought thereabout , it is not the beames, and light of the thing it selfe, which strengthen vs against such opposition, but the goodnesse of the party vpon whom we rely.

8. Why truth is the perfection of a reasonable soule: and why it is not found in simple apprehensions as well as in Enuntiations.

Before I go any further, I must needes remember one thing, that our Masters teach vs : which is, that truth and falsehood are first found in sayings or *Enuntiations*; and that although single apprehensions are in our mind before these iudgements , yet are they not true or false themselues, nor is the vnderstanding so by them. To comprehend the reason of this maxime, lett vs consider what truth and falsehood are: surely truth is nothing else, but the confirmity of our vnderstanding, with the thinges that make impression vpon it: and consequently , falsehood is a disagreeing betweene our mind and those thinges : if the existence which the thinges haue in vs, be agreeable to the Existence they haue in themselues;

ſelues; then our vnderſtanding is true; otherwiſe it is falſe. Now the naturall perfection of our Soule or vnderſtanding, is to be fraught-wight the reſt of the whole world, that is haue the knowledge of all thinges that are; the knowledge of their eſſences, of their natures, of their proprieties, of their operations, and of whatſoeuer elſe belongeth to them all in generall, and to euery one of them in particular: but our ſoule can not be ſtored or fraught with any thing, by other meanes then by her aſſent or deeming: wherevpon it followeth, that she can not haue her perfection, vntill her deemings or iudgements be perfect; which is, that they be agreeable vnto the thinges in the world: when they are ſo, then are they true. And this is the reaſon why truth is the ayme and perfection of the ſoule. Now then, truth reſiding only in the aſſents and iudgements of the ſoule, (which are the trafficke whereby she enricheth her ſelfe with the reſt of the world) and they being framed by her diſcerning an identity betweene two thinges; which she expreſſeth by affirming one of them of the other: it followeth, that nothing can be true or falſe, but where there is a compoſition of two extremes, made by the ones being affirmed of the other; which is done only in Enuntiations or iudgements: whiles ſingle apprehenſions aſſent to nothing, and therefore ſettle no knowledge in the ſoule; and conſequently are not capable of verity or falſity, but are like pictures made at fanſy, ſome one of which may happen to be like ſome Perſon, but can not be ſaid to be the picture of him, becauſe it was not drawne from him: ſo theſe bare apprehenſions, becauſe there is not in the man vnion of the ſoule to the outward world, or to the Exiſtence which actuateth its obiect, therefore they make not the ſoule to be the image of the thinges exiſtent: but the iudgement, which ſtill taketh a thing exiſtent, or as exiſtent, in the ſubiect of the propoſition, draweth its picture from the thing it ſelfe: and therefore it maketh the ſoule to be well or ill painted, in reſpect of the thing that is true or falſe.

And this is the reaſon, why in one ſenſe doubtfull propoſitions, which the vnderſtanding (not being yet reſolued) maketh inquiringly to informe it ſelfe of the truth of them, can not be ſaid to be true or falſe; for all that while, the ſoule yieldeth no aſſent vnto them, eyther one way or other; yet in an other ſenſe they may, which is, taking them as ſubiects that the vnderſtanding determineth vnto it ſelfe to treate of: for there being two extremes in them, and the propoſition conſiſting in this, whether theſe extremes be identifyed or no, it followeth, that ſince one part muſt of neceſſity be, ſuch a propoſition ſpoken at randome, or written by chance without deſigne, is of neceſſity eyther true or falſe; according as the extremes of it, are or are not one thing.

9. what is a ſolid iudgement, and what a ſlight one.

There occurreth no more vnto my conſideration to be ſaid in this place, concerning the aſſents and iudgements of the mind: vnleſſe it be, to explicate in a word or two, the ſeuerall qualities of them, which are found in ſeueral Perſons; and to point at the reaſon why they are called

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by thoſe names, which they are vniuerſally knowne by. To which purpoſe we may obſerue, that iudgement or *deeming*, being a quieting of the mind, it followeth that the mind muſt needes be in diſquiet and at vnreſt, before it cometh to iudge: ſo that we may conclude, that iudgement or thinking, is a good attained by a former motion. Now according to the quality of this motion, the iudgement or aſſent, is qualifyed and denominated. We muſt therefore conſider what belongeth to motion; which when we haue done, we shall in iudgements find ſomething proportionable therevnto.

We know there is a beginning and an ending in motion; and that there are partes by which it is drawne out in length: all which muſt be particularly conſidered, in our comparing of motions vnto iudgemẽts. Now then, as he that would know preciſely the nature of any motion, muſt not beginne his ſuruay of it, after it hath beene ſome time in fluxe; nor muſt giue ouer his obſeruing it, before it haue arriued vnto its vtmoſt periode; but ought to carry his attention along from its firſt origine, and paſſe with it through all its partes, vntill it ceaſing, giue him leaue to do ſo too (for otherwiſe, it may happen that the courſe of it be differing in thoſe partes he hath not obſerued, from thoſe that he hath, and accordingly, the picture he shall make of it by that imperfect ſc ntling, will proue an erroneous one;) ſo in like manner, when a man is to make a *iudgement* of any matter in queſtion, to giue a good account of it, he muſt beginne at the roote, and follow ſucceſſiuely all the branches it diuideth it ſelfe into, and driue euery one of them to their vtmoſt extremity and periode: and according as in iudging he beheaueth himſelfe well or ill, in the ſeuerall circumſtances that are proportionable to the beginning, ending, and partes of motion; ſo his iudgement is qualifyed with the names of ſeuerall vertues agreeing therevnto, or of their oppoſite defects.

If he beginne his conſiderations very lowe, and from the very bottome and roote of the affaire, which is from the firſt and all comprehending principles of the queſtion, and proceede on orderly taking all before him; his iudgement is accounted *deepe, profound, and ſolide*: for he that caſteth ſo farre, as to leaue behind him no part of the matter he is inquiring about, and then driueth his courſe ſteadily and ſmoothly forwardes, without any leapes ouer rugged paſſages, or interruptions, or looſe breaches; muſt of neceſſity make a well grounded iudgement; and ſuch an one, as can not eaſily be ouerthrowne, or he be eaſily remoued from it.

And this is indeede the full reaſon, of what a litle aboue we only glanced att: namely, why vnderſtanding men are vſually accounted obſtinate in their tenets, and are hard to be remoued from their opinions once ſettled in their minds: for when other men oppoſe them, they vrge nothing (for the moſt part) againſt theſe iuditious mens reſolutions or beliefes, but what they haue already throughly foreſeene: but theſe on the other

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the other ſide, do ſee a great deale, that their oppoſers reach not vnto; ſo that notwithſtanding all ſuch oppoſition, they continue ſtill vnshaken in their *iudgements*: for which, the others which ſee not as much as they, do thinke them obſtinate, and not ledde by reaſon, becauſe they follow not that short reaſon, beyond which themſelues can not reach.

The contrary vice to this, is called a *ſlight iudgement*: and conſiſteth herein, that a man out of a few, and an inſufficient number of circumſtances, reſolueth the whole caſe: which temerity and short ſightedneſſe of iudgement, is ſignificantly taxed in our English prouerbe, that *a fooles bolt is ſoone shott.*

10. What is an acute iudgement, and what a dull one.

Thus much for the beginning of a iudgement: the next conſideration may be concerning the end of it; in regard whereof, if it reach to the vtmoſt extent and periode of what is conſiderable in a hard queſtion propoſed, it gaineth the title of *sharpe*, or of *ſubtile*, and *acute*; for the hardneneſſe of the matter that perplexeth ones iudgement, conſiſteth in the inuolution of thinges, which looked vpon in groſſe, do ſeeme to haue no diſtinction or oppoſition among themſelues; and yet are in truth of very different and contrary natures. Now a good iudgement diuideth and cutteth through them, and allotteth vnto euery particular thing its proper limits and boundes: wherefore, as in corporeall ſubſtances, the vertue of diuiding is sharpeneſſe and edge, by tranſlation from thence, ſuch a iudgement as pierceth neately and ſmartly betweene contradictories that lye cloſe together, is called *sharpe* and *acute*. In like manner, *ſubtility* is a vertue, whereby a liquor or other body ſearcheth euery litle hole and part of what it worketh vpon, till it gett through it; and from thence, it is vſed in iudgements to ſignify the ſame: whoſe oppoſite vice is called *dulleneſſe*.

11. In what conſiſteth quickneſſe and Cleareneſſe of iudgement: and there opoſite vices.

In the laſt place we are to examine, what proportion a iudgement holdeth with the partes of motion: in theſe, two thinges are to be conſidered, namely the quantity or multitude of thoſe partes, and the order of them. As for the quantity in a motion, it belongeth eyther to long or short, or to quicke and ſlow: now, where the beginning and ending are already knowne and determined, and conſequently where the length is determined, and dependeth not at all of the iudge to alter it, (for he muſt take it as the matter giueth it) there a iudgement can acquire no denomination of perfection or deficiency, from length or from shortneſſe; for they belong originally to the matter of the iudgement; and the iudgement muſt accordingly fitt it ſelfe to that; and therefore is lyable neyther to commendations nor to reproach, for being long or short: it remaineth then, that the vertue in *iudging* anſwerable to the quantity of motion, muſt conſiſt in quickeneſſe and celerity; and the contrary vice, in ſlowneſſe and heauyneſſe.

As for order in the ſeuerall partes of motion, we know that if they be well ordered, they are diſtinct and eaſily diſcernable. Which vertue, in our ſubiect, is called *cleereneſſe of iudgement*; as the contrary vice is *confuſion.*

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THE THIRD CHAPTER.

Of Diſcourſing.

1. How diſcourſe made.

IN the laſt Chapter we haue shewed, how two apprehenſions ioyned together do make a iudgement: now in this our firſt employment will be, to shew how three of theſe thoughts or iudgements, well choſen and duely ordered, do compoſe the firſt and moſt ſimple of perfect diſcourſes; which Logitians call a ſyllogiſme: whoſe end and effect is to gaine the knowledge of ſomething, before hidden and vnknowne. The meanes whereby this is compaſſed, is thus. By the two firſt iudgements, we ioyne the extremes of the propoſition we deſire to know, vnto ſome third thing; and then, by ſeeing that they both are one third thing, and that one can be but one, we come to diſcerne, that truly one of them is the other; which before we ſaw not: ſo that, the *identity* which firſt made an identicall propoſition be knowne and agreed vnto, and afterwardes cauſed the like aſſent to be yielded vnto thoſe maximes, whoſe identification preſently shewed it ſelfe, now by a litle circuit and bringing in of a third terme, maketh the two firſt (whoſe identification was hidden and obſcure, whiles we looked vpon the termes themſelues) appeare to be in very truth but one thing.

2. Of the figures and moodes of Syllogiſmes.

The various mingling and diſpoſing of theſe three termes in the two firſt propoſitions, begetteth a variety in the ſyllogiſmes that are compoſed of them: and it conſiſteth in this, that the aſſumed terme vnto which the other two are interchangeably ioyned, is eyther ſaid of them, or they are ſaid of it: and from hence ſpring three different kindes of ſyllogiſmes; for eyther the aſſumed or middle terme, is ſaid of both the other two; or both they are ſaid of it; or it is ſaid of one of them, and the other is ſaid of it: neyther is there any deeper myſtery then this, in the three figures, our great Clerkes talke ſo much of: which being brought into rules, to helpe our memory in the ready vſe of this tranſpoſition of the termes; if we ſpinne our thoughts vpon them into ouer ſmall thriddes, and thereof weaue too intricate webbes (meane-while not reflecting vpon the ſolide ground within ourſelues, where on theſe rules are built, nor conſidering the true end why;) we may ſpend our time in triuiall and vſeleſſe ſubtilities: and at length, confound and miſapply the right vſe of our naturall diſcourſe, with a multitude of precepts drawne from artificiall logike.

But to returne to our matter in hand; vnder this primary threefold variety, is an other of greater extent, growing out of the diuers compoſition of the three termes, as they are qualifyed by *affirmation* or *negation*, and by

and by *vniuerſality* or *particularity*: for that vnity, which the two termes, whoſe identification is enquired after, muſt haue by being ioyned with the third, becometh much varied by ſuch diuers application: and from hence shooteth vp that multitude of kindes of ſyllogiſmes, which our Logitians call moodes. All which I haue thus particularly expreſſed, to the end we may obſerue how this great variety hangeth vpon the ſole ſtring of *identity*.

3. That the life of man as man, doth conſiſt in diſcourſe, and of the vaſt extent of it.

Now theſe Syllogiſmes, being as it were interlaced and wouen one within an other, (ſo that many of them do make a long chaine, whereof each of them is a linke) do breede, or rather are all the variety of mans life: they are the ſtepps by which we walke in all our conuerſations and in all our buſineſſes: man as he is man, doth nothing elſe but weaue ſuch chaines: whatſoeuer he doth, ſwaruing from this worke, he doth as deficient from the nature of man: and if he do ought beyond this, by breaking out into diuers ſortes of exteriour actions, he findeth neuertheleſſe in this linked ſequele of ſimple diſcourſes, the art, the cauſe, the rule, the boundes, and the modell of it.

Lett vs take a ſummary view of the vaſt extent of it, and in what an immēſe Ocean one may ſecurely ſayle, by that neuer varying compaſſe, when the needle is rightly touched, and fitted to a well moulded boxe; making ſtill new diſcoueries of regions, farre out of the ſight and beliefe of them, who ſtand vpon the hither shore. Humane operations are compriſed vnder the two generall heades of *knowledge* and of *action*: if we looke but in groſſe, vpon what an infinity of diuiſions theſe branch themſelues into, we ſhall become giddy, our braines will turne, our eyes will grow weary and dimme, with ayming only att a ſuddaine and rouing meaſure of the moſt conſpicuous among them, in the way of knowledge. We ſee what mighty workes men haue extended their labours vnto; not only by wild diſcourſes, of which huge volumes are cōpoſed, but euen in the rigorous methode of Geometry, Arithmetike, and Algebra; in which, an Euclide, an Apollonius, an Archimedes, a Diophantus, and their followers, haue reached ſuch admirable heights, and haue wound vp ſuch vaſt bottomes, ſometimes shewing by effects, that the thing propoſed muſt needes be as they haue ſett downe, and can not poſſibly be any otherwiſe; otherwhiles, appaying the vnderſtanding (which is neuer truly at reſt, till it hath found the cauſes of the effects it ſeeth) by expoſing how it cometh to be: ſo that the reader calling to mind, how ſuch a thing was taught him before, and now finding another vnexpectedly conuinced vpon him, eaſily ſeeth that theſe two put together, do make and force that third to be, whereof he was before in admiration how it could be effected: which two wayes of diſcourſe, are ordinarily knowne by the names of *Demonſtrations*; the one called *a Priori*, the other *a Poſteriori*.

Now if we looke into the extent of the deductions out of theſe, we shall find no end. In the heauēs, we may perceiue Aſtronomy meaſuring

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whatsoeuer we can imagine; and ordering those glorious lights, which our Creator hath hanged out for vs; and shewing them their wayes, and pricking out their pathes, and prescribing them (for as many ages as he pleaseth before hand) the various motions they may not swarue from in the least circumstance. Nor want there sublime soules, that tell vs what mettall they are made of, what figures they haue, vpon what pillars they are fixed, and vpon what gimals they moue and performe their various periodes: wittnesse that excellent and admirable worke, I haue so often mentioned in my former Treatise. If we looke vpon the earth, we shall meete with those, that will tell vs how thicke it is, and how much roome it taketh vp: they will shew vs how men and beastes are hanged vnto it by the heeles; how the water and ayre do couer it; what force and power fire hath vpon them all; what working is in the depths of it; and of what composition the maine body of it is framed: where neyther our eyes can reach, nor any of our senses can send its messengers to gather and bring back any relations of it. Yet are not our Masters contented with all this: the whole world of bodies is not enough to satisfy them: the knowledge of all corporeall thinges, and of this vast machine of heauen and earth, with all that they enclose, can not quench the vnlimited thirst of a noble minde, once sett on fire with the beauty and loue of truth.

Dialo: de mundo.

Æstuat infœlix, angusto limite mundi,
Vt Gyara clausus scopulis, paruâque seripho.

But such heroike spirits, cast their subtile nettes into an other world, after the winged inhabitans of the heauens; and find meanes to bring them also into account, and to serue them (how imperceptible soeuer they be to the senses) as daynties at the soules table. They enquire after a maker of the world we see, and are ourselues a maine part of; and hauing found him, they conclude him (out of the force of contradiction) to be æternall, infinite, omnipotent, omniscient, immutable, and a thousand other admirable qualities they determine of him. They search after his tooles and instruments, wherewith he built this vast and admirable pallace, and seeke to grow acquainted with the officiers and stewardes, that vnder him gouerne this orderly and numerous family. They find them to be inuisible creatures, exalted aboue vs more then we can estimate, yet infinitely further short of their and our maker, then we are of them. If this do occasion them, to cast their thoughts vpon man himselfe, they find a nature in him (it is true) much inferiour to these admirable *Intelligences*, yet such an one, as they hope may one day arriue vnto the likenesse of them: and that euen at the present, is of so noble a moulde, as nothing is too bigge for it to faddome, nor any thing too small for it to discerne.

Thus we see knowledge hath no limits; nothing escapeth the toyles of science; all that euer was, that is, or can euer be, is by them circled in: their

their extent is so vast, that our very thoughts and ambitiõs are too weake and too poore to hope for, or to ayme at what by them may be cõpassed. And if any man, that is not invred to raise his thoughts aboue the pitch of the outward obiects he cõuerseth dayly with, should suspect that what I haue now said, is rather like the longing dreames of passionate louers, whose desires feede them with impossibilities, then that it is any reall truth; or should imagine that it is but a poetike Idea of science, that neuer was or will be in act: or if any other, that hath his discoursing faculty vitiated and peruerted, by hauing beene imbued in the schooles with vnsound and vmbratile principles, should persuade himselfe, that howsoeuer the pretenders vnto learning and science, may talke loude of all thinges, and make a noise with scholastike termes, and persuade their ignorant hearers that they speake and vnfould deepe mysteries, yet in very truth, nothing at all can be knowne: I shall beseech them both, to suspend their coniectures or beliefes herein, and to reserue their censure of me, whether or no I haue strained too farre, vntill the learned author of the Dialogues of the world, haue enriched it with the worke he hath composed of Metaphysikes: in which, going orderly and rigorously by continued propositions, in such sort as Mathematicians demonstrate their vndertakinges, he hath left no scope for wrangling braines to make the least cauill against his doctrine: and casting his sharpe sighted thoughts ouer the whole extent of nature, and driuing them vp to the Almighty Authour of it, he hath left nothing out of the verge of those rules, and allcomprehending principles he giueth of true science. And then I doubt not, but they will througly absolue me frõ hauing vsed my amplification, in ayming at the reach of this allgrasping power. For my part, the best expression that I am able to make of this admirable piece, I must borrow from witty Galileus, when he speaketh of Archimedes his long missed booke of glasses; and professe, that hauing some of the Elements or bookes of it entrusted in my handes by the Authour, I read them ouer with extreme amazement, as well as delight, for the wonderfull subtility, and solidenesse of them.

4. Of humane actions, and of those that concerne ourselues.

Thus much for knowledge. Now lett vs cast an eye vpon humane actions. All that we do (if we do it as we should do, and like men) is gouerned and steired by two sortes of qualities: the one of which, we call *Artes*; the other *Prudences*. An art, is a collection of generall rules, comprehending some one subiect, vpon which we often worke. The matters we worke vpon (out of which the particular subiects of artes do spring) are of three kindes: our selues, our neighbours, and such dumbe or insensible thinges, as compose the rest of the world.

Our actions vpon our selues, are the highest and the noblest of all the rest, and those by which we liue and worke as men: or to expresse my selfe better, they are those by which we perfect that part of vs, which maketh vs men, and by which we direct and leuell all we do, according to the rule of reason; not suffering our actions to swarue from what she

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dictateth vnto vs. This is done, by multiplying and heightning the thoughts of those thinges, which maintaine vs in reason; whether the motiues be morall, as the examples of worthy persons, and the precepts and persuasions of wise men, and the like; or whether they be naturall, as the consideration of the sweete and contented life, which vertue giueth ve here, by good conuersation, honour, profit, quiet, pleasure, and what else soeuer groweth out of so excellent a roote: as also, of the beatitude and happy state it bringeth vs to in the next; and of the contrary effects which spring from vice. Againe, by obseruing the motiues and wayes of our passions and animall desires, we learne how to preuent them; how to terrify them; and how to weare them gently away by litle and litle, through sometimes giuing them diuersions, through otherwhiles restraining them with moderation, and through oftentimes cutting of the occasions, and abridging them of their naturall encreasings. All these thinges are brought into art and rule; whose lessons, were men but as carefull and industrious to studie, as they are to become Masters in vaine and triuial thinges, they would enioy happy lifes.

5. Of humane actions as they concerne our neighbours.

In the next place, we are to consider the actions whereby we worke vpon our neighbours. They are chiefely *gouuernement* and *negotiation*: both which are of one kind; and haue but this difference, that the one is done in common, the other is performed in particular. The meanes by which we command, are rewards and punishments; which who hath in his handes, may assuredly by wise vsing them, bring to passe whatsoeuer he hath a mind vnto.

Vpon occasion of mentioning these two powerfull motiues, which haue so maine an influence in mens actions, we may note by the way, that many of them, and that worke most forcibly vpon mens mindes, are thinges whose subsistence we know not where to find; as honour, praise, glory, command, singularity, eminency, shame, infamy, subiection, reproach, and the like: vnto any of which, none of our senses can reach; and yet they gouerne mans life, in a manner wholy and perfectly.

In *negotiation*, we propose to single men their owne interests and profits; not such as the proposer can, or will effect; but such as are likely to arise out of the action we endeauour to draw him vnto with whom we treate. In both these, the vsuall labour is, to make our neighbours willing to leaue some present good, in hope of a greater to come; or to be content to vndergoe some present harme, for feare of a greater to ensue. The generall instrument which they vse, is *discoursing*; whose vertue consisteth partly in our owne mind, and partly in deliuering our mind to others: for first we must know what we should say, and next in what manner we should say it.

6. Of Logike.

The art which directeth our owne minde, and teacheth vs what to say, is *Logike*: whose partes are two; according as the affaires falling into discourse, are likewise of a twofold nature: the one instructeth vs how to manage

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manage and order our reaſon, when it dealeth with ſuch ſubiects as we may attaine to certainety in. And here the rules of *Demonſtration* take place; teaching vs to define, to diuide, and to cõclude. The other inſtructeth vs how to behaue ourſelues, when we meete with ſuch ſubiects, as a good and probable gueſſe is the fartheſt we can reach vnto towardes the knowledge of them: and for theſe, the *Topicall* part of Logike ſerueth; the which, taking a view of all the accidents belonging to any thing propounded, sheweth how to draw probabilities from euery one of them.

7. Of Grammar.

Our diſcourſing to others, is eyther to open our mindes barely vnto them; or to perſuade them of ſomewhat ourſelues beleeue; or to winne them to ſomewhat we would haue them do. For the bare deliuery of our mindes to others, we haue *Grammar*; the ſcope of which art, conſiſteth firſt, in teaching vs to deliuer our conceptions plainely and clearely, (which is the maine intent of ſpeaking) next, in making, our diſcourſe be ſuccinct and briefe, (which is the meaſure of our ſpeaking, both for ourſelues and others;) and laſtly, in ſorting our wordes, ſo as what we ſay, may be accompanied with ſweeteneſſe; both in commõ, in regard of the eare, by auoyding ſuch harsh ſoundes as may offend it; and in particular, in regard of the cuſtome of the language wherein we ſpeake, and of the perſons tõ whom we ſpeake.

8. Of Rhetorike.

The art whereby we may perſuade others, and winne them to aſſent vnto what we would haue them, is *Rhetorike*. Her rules inſtruct vs how to diſpoſe and order with beſt aduantage, in regard of the Auditors diſpoſition, both the reaſons which *Logike* affordeth vs, and the wordes which *Grammar* ſtoreth vs with: as alſo, how to giue life and motion to what we ſay, by our action and geſture; that ſo we may perſuade our Auditory, ſuch paſſions raigne in vs, as we ſeeke to ſtirre vp in them: for as we may obſerue, that one who yawneth, maketh an other likewiſe yawne; and as our ſeeing others laugh, prouoketh laughing alſo in vs (the reaſons whereof we haue touched in the former Treatiſe;) after the ſame manner, what paſſion ſoeuer we exhibite in ourſelues, the ſame ſtealeth inſenſibly vpon thoſe we ſpeake vnto; whiles their mind attending to the wordes they heare, is not aware of the ſubtile ſpirits motions, that by a kind of contagion riſe and ſwell in their hartes: according to which naturall inclination in all men, the Maſter of Poets and excellent obſeruer of mens humours ſaid paſſing well:

Si vis me flere, dolendum eſt
Primùm ipſi tibi.

Hence grow thoſe encreaſes by metaphores, hyperboles, and other tropes and figures: hence thoſe feruors by interrogations, exclamations, apoſtrophes, and the like; which when they are fittely placed, they carry the Auditor euen againſt his will.

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9. Of Poetry.

Poetry, is not a gouernour of our Actions, but by aduantagious expreſſing ſome eminent ones, it becometh an vſefull directour to vs; and therefore challengeth a place here. The deſigne of it is, by repreſenting humane actions in a more auguſt and admirable hew, them in themſelues they vſually haue: to frame ſpecious Ideas, in which the people may ſee, what is well done, what amiſſe, what should be done, and what by errour is wont to be done: and to imprint in mens mindes a deepe conceite of the goods and euils, that follow their vertuous or vitious comportement in their lifes.

If thoſe who aſſume the title of *Poets*, did ayme at this end, and would hold themſelues ſtrictly to it, they would proue as profitable inſtrumẽts as any the commõwealth had: for the delightfullneſſe and blitheneſſe of their compoſitions, inuiteth moſt men to be frequently conuerſant with them; (eyther in ſongs, or vpon the ſtage, or in other Poemes) whiles the ſober aſpect and ſeuerity of bare precepts, deturneth many from lending a pleaſed eare to their wholeſome doctrine; and what men ſwallow with delight, is conuerteth into nourishmẽt: ſo that, if their drift were to ſettle in mens mindes a due valuation of vertue, and a deteſtation of vice, no art would do it more vniuerſally, nor more effectually: and by it, mens hartes would be ſett on fire to the purſuite of the one, and be shrunke vp with diſlike and horrour againſt the other. But vnto ſuch a Poet as would ayme at thoſe noble effects, no knowledge of *Morality*, nor of the nature and courſe of humane actions and accidents muſt be wanting: he muſt be well verſed in *Hiſtory*; he muſt be acquainted with the progreſſe of nature, in what she bringeth to paſſe; he muſt be deficient in no part of *Logike*, *Rhetorike*, or *Grammar*: in a word, he muſt be conſummate in all artes and ſciencies, if he will be excellent in his way.

10. Of the Power of ſpeaking.

But whiles we thus entertaine ourſelues with thoſe artes, which ſerue vs in diſcourſing with others, it were a great ouerſight to forgett that faculty, which is the *baſis* and groundworke of all thoſe: and that is, the power of ſpeech, which nature hath beſtowed vpon vs. It conſiſteth in two actions: the one outward, the other inward: the outward, is the giuing of various ſoundes to our breath, as it paſſeth through our mouth, by diuers coniunctions of our tongue, teeth, and lippes, to themſelues, or to diuers parts of our mouth, or by their ſeparations from them: in which, we ſee that birdes are able to imitate vs, and I am perſuaded, the like might be effected by inſenſible creatures, if a dexterous man would employ his time, in contriuing and making an inſtrument to expreſſe thoſe different ſoundes; which, not hauing more then ſeuen ſubſtantiall differences beſides the vowels (as ſome who haue carefully noted them, do affirme) it would peraduenture be no hard matter to compoſe ſuch an engine.

The inward action of locution, is the framing of conuenient anſweres to what is asked; of fitt replies to what is ſaid; and in a word, to

ſpeake

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ſpeake appoſitely, and to the purpoſe: wherevnto, neyther beaſt nor dead inſtrument can be brought, vnleſſe the artificier be able to endue it with vnderſtanding.

All other artes, inſtruct vs how to worke orderly vpon beaſtes and inſenſible bodies: by ſome of them, we cultiuate liuing creatures; as when husband men nourish sheepe, oxen, foule, and the like, for ſlaughter: by others, we diſcipline them, as when we teach horſes, dogges, apes, hawkes, parrats, and ſome kind of fishes, to hunt, to play, and in a word, to do ſomewhat eyther for our profit, or for our pleaſure: and againe, by others we vſe their natures to our endes; as when we lay baites to catch them; when we ſett egges vnder hennes, to haue the chickens, and the like: by other artes, we worke as powerfully vpon inſenſible creatures; among which, by knowing the natures of diuers trees, herbes, minerals, &c: we are able to bring any of them to what vſe ſoeuer we find moſt expedient for our ſeruice: from hence grow all thoſe artes and trades, in which we ſee men dayly ſpend their whole lifes; ſo as it is needeleſſe to inſiſt vpon the particulars of them, ſince townes and the citties are compoſed of the ſeuerall tribes of perſons that profeſſe them and liue by them.

11. Of arts that concerne dumbe and inſenſible creatures.

But we muſt not leaue this ſubiect, without noting how admirably mans witt turneth it ſelfe to ſo different ſortes, and to ſuch an infinite variety of thinges. For what man is there, (if he be a man) but might haue become Maſter in any of theſe ſo differing trades, in caſe he had applyed himſelfe as conſtantly to that, as he hath done to ſome other he is perfect in? Againe, lett vs conſider how it happeneth often, that he doth not the ſame thing twice the ſame way, but according to his owne, or an other mans fanſie, changeth his worke at will, now doing it after one fashion, now after an other; as hauing no law or determination from nature, but being wholy left to his owne direction.

There ſtill remaineth one art, not yet ſpoken of; which knoweth not where to challenge a place, whether among the moderatours of our owne actions, or among thoſe whereby we gouerne thinges: and that is *Arithmetike*: which ſeemeth to belong vnto thinges, and yet it meddleth not with them: and againe, it ſeemeth to be a maine directour of our internall actions, and yet belongeth neyther to *Morals*, nor to *Logike*. Whereſoeuer its due be to place it, I am ſure it is not to be forgottē; ſeeing it is ſo principall an one, as our life can hardly conſiſt without it. It worketh vpon notions that are no where; for euery thing that is in the world, is but one; and to be, or to make a number, can not happen without an vnderſtanding: the affections likewiſe of them, are as the ſubiect, all inuiſible; as to be euen or odde, to be cubes, ſquares, rootes, &c: and yet how great the power and extent of this art is, none can rightly vnderſtand or beleeue, but he that hath the knowledge of it, or hath ſeene the vertue and efficacity of it.

12. Of Arithmetike.

All theſe artes, conſiſt in common rules, which require the ſecond of

13. Of Prudence.

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thoſe qualities, whereby we ſaid humane actions are gouerned, to apply them to their particular matter: and that is *Prudence*; which we may define to be, a quality or power, by whoſe aſſiſtance we apply vnto the matter we are to worke vpon, ſuch inſtruments, as in our preſent iudgement appeare fitteſt to bring it to that paſſe, which ſerueth beſt for our intentions, when by our ſenſes, or by other gueſſes, we know the particular diſpoſitions of the matter, and of the inſtruments wherewith we are to change it. Now howbeit this occurreth generally in all artes, yet its ſpeciall place and neceſſity, is in gouerning and moderating our owne or other mens *Morall* actions; and accordingly, its name is eſpecially addicted therevnto: and that man is ſaid to be prudent or diſcreete, who gouerneth himſelfe and others well.

This quality of *Morall Prudence* in generall, is diuided into three particular ones: the firſt of which, belongeth to a gouernour in a ſtate or commonwealth: the next may be aſſigned to him that is skilfull in the lawes: and the third concerneth the managing and conduct of military actions. The reaſon of this long receiued diſtribution peraduenture is, becauſe in theſe occurrences, our paſſion ſwayeth vs generally more then in any others: and the operation and effect of *Prudence*, (whoſe prouince is to curbe and moderate our paſſions by reaſon) is greateſt, and appeareth moſt in thoſe ſubiects, where paſſion raigneth vſually with greateſt impetuoſity.

14. Obſeruations vpon what hath beene ſaid in this Chapter.

Thus haue we runne ouer the maine partes of diſcourſe, and the generall heades of mans action as man: which peraduenture may through their numerouſneſſe, appeare to be as it were but looſely ſcattered from our penne; (as happeneth vnto all materials, that muſt ſerue for after buildinges; and that till they be employed, require no more but ſorting, and laying together in ſeuerall heapes, to the end they may be ready for vſe:) and therefore before we go any further, it will not be amiſſe to make reflexions vpon what we haue ſaid; and to draw it neerer our intended ſcope; and to ſquare out and giue ſome figure and polishing to theſe ſtones, here where we digge them out of the quarry, whereby they may hereafter with leſſe adoe, fitt the places we haue aſſigned them, in the ſtructure we intend: and ſo, a litle trouble here, whiles our tooles are ſtill in our handes, and our matter lyeth ready for our ſtroakes, and our thoughts are warmeth with working vpon them, may ſaue vs a great deale there, where our maine employment will be, to lay artificially, and to ioyne cloſely, what now we but hew out: and therefore will require finer inſtruments, and a sharper edge, then what at preſent ſerueth our turne.

Lett vs then bring backe to account all we haue ſaid in this Chapter: and when we haue well reflected vpon euery particular, we ſhall find they all agree in this, that they are nothing elſe, but a due ordering of one thing with an other: a ſyllogiſme, is an ordering of ſome few notions: a ſcience is an ordering of ſyllogiſmes, in ſuch ſort, as a new

propoſition

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propoſition may follow out of thoſe which went before: and as we ſe that when by our thoughts diuers ſyllogiſmes are well ordered, hidden thinges come to be diſcloſed in our vnderſtanding; euen ſo among bodies, if thinges whoſe proprieties are knowne, be likewiſe ordered and put together, thoſe very effects, which were diſcouered by the ordering of notions in our head, will ſpring forth in nature: as for example, if by knowing the natures of fire and of towe, our diſcourſe findeth that towe put to fire will preſently become fire, the ſame will happen in nature, if we put materiall towe, or ſome other body that hath the qualities of it, to reall fire, or to ſome other ſubſtance that is endewed with the vertues of fire: in like manner, if by knowing that colours are nothing elſe, but various mixtures of light and of darkeneſſe in bodies, our diſcourſe aſſureth vs, that by ſeuerall compoundings of theſe extremes, reds, blewes, yellowes, greenes, and all other intermediate colours may be generated; accordingly we shall find in effect, that by the ſeuerall minglings of blacke and white bodies (becauſe they reflect or drowne light moſt powerfully) or by interweauing ſtreames of pure light and of shadowes one with an other, we may procreate new colours in bodies, and begett new luminous appearances to our eyes: ſo that hence it appeareth clearely, that the ſame nature is in our vnderſtanding, and in the thinges: and that the ſame ordering, which in the one maketh ſcience, in the other cauſeth naturall tranſmutations.

An other reflexion, which will be fitt for vs to make vpon theſe long diſcourſes, is this, that of neceſſity there muſt be a ioyning of ſome thinges now actually in our knowledge, vnto other thinges we thinke not of: for it is manifeſt, that we can not at the ſame time actually thinke of a whole booke of Euclide; and yet to the due knowledge of ſome of the laſt propoſitions, the knowledge of almoſt all the former is required: likewiſe it is impoſſible we should at the ſame time thinke of all the multitude of rules belonging to any art, as of Grammar, of Metering, of Architecture; and yet when we write in Latine, make a poeme, or lay the deſigne of a houſe, we practiſe them whiles we thinke not of them, and are aſſured we goe not againſt them, howeuer we remember them not.

Nay, euen before we know a thing, we ſeeme to know it; for ſince we can haue a deſire of nothing, but of what we know, how could we deſire to know ſuch or ſuch a thing, vnleſſe we know both it, and the knowledge of it? And for the moſt part we ſee a horſe, or man, or herbe, or workemanshippe, and by our ſenſe haue knowledge that ſuch a thing it is, before we know what, or who, or how, it is: that groweth afterwardes out of the diligent obſeruation of what we ſee: which is that, whereby learned men differ from the vnlearned, for what ſtriketh the ſenſe, is knowne a like by them both: but then here is the difference betweene them, the later ſort ſitteth ſtill with thoſe notions, that are made at the firſt, by the beating of our ſenſe vpon vs, without driuing them any

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further: and those that are learned, do resolue such compounded notions, into others made by more common beatinges, and therefore more simple: and this is all the oddes in regard of knowledge, that a scholler hath of an vnlettered man.

One obseruation more we will draw out of what we haue said, and then end this Chapter: it is, how a man doth oftentimes enquire among his owne thoughts, and turneth vp and downe the images he hath in his head, and beateth his braines, to call such thinges into his minde, as are vsefull vnto him, and are for the present out of his memory: which, as we see it so necessary, that without it no matter of importance can be performed in the way of discourse (whereof I my selfe haue too frequent experience in the writing of this Treatise) so on the other side, we can not perceiue that any creature besides man, doth it of sett purpose and formally as man doth.

THE FOVRTH CHAPTER.

How a man proceedeth to Action.

1. That humane actions proceed from two seuerall principles, vnderstanding and sense.

HAuing thus taken a summary view of the principall Qualities a man is endewed withall, *Apprehending*, *Iudging*, and *Discoursing*; and hauing shewed how he is enriched in and by them with the natures of all thinges in the world; it remaineth for our last worke in this part, to consider in what manner he maketh vse of this treasure in his ordinary actions: which it is euident are of two different kindes, and consequently haue two seuerall principles, vnderstanding and sense; these sway by turnes, and sometimes ioyne together, to produce a mixed action of both.

If only sense were the fountaine from whence his actions spring, we should obserue no other straine in any of them, then meerely that according to which beastes performe theirs: they would proceede euer more in a constant vnuaryable tenour, according to the law of materiall things, one body working vpon an other, in such sort as we haue declared in the former Treatise.

On the other side, if a man were all vnderstanding, and had not this bright lampe enclosed in a pitcher of clay, the beames of it would shine without any allay of dimmenesse, through all he did; and he could do nothing contrary to reason, in pursuite of the highest end he had prefixed vnto himselfe; for he neyther would, nor could do any thing whatsoeuer, vntill he had first considered all the particular circumstāces, that had relation to his action in hand; and had then concluded, that vpon the whole matter, at this time, and in this place, to attaine this end, it is fitting and best to do thus or thus: which conclusion could be no sooner made, but that the action would without any further disposition on his

on his ſide, immediately enſue, agreeable to the principles it ſpringeth from. Both partes of this aſſertion are manifeſt: for the firſt, it is euident, that whenſoeuer an Agent worketh by knowledge, he is vnreſolued whether he ſhall worke or not worke, as alſo of his manner of working, vntill his knowledge (that ought to direct and gouerne his working) be perfect and complete: but that can not be, as long as any circumſtance not as yet conſidered, may make it ſeeme fitt or vnfitt to proceede: and therefore, ſuch actions as are done without exact conſideration of euery particular circumſtance, do not flow from a pure vnderſtanding. From whence it followeth that when an vnderſtanding is not ſatisfyed of euery particular circumſtance, and conſequently can not determine what he muſt immediately do, but apprehendeth that ſome of the circumſtances not as yet conſidered, may (or rather muſt) change ſome part of his action, it muſt of neceſſity be vndetermined in reſpect of the immediate action; and conſequently, it muſt refraine abſolutely from working. The other part is cleare; to witt, that when the vnderſtanding, vpon conſideration of all circumſtances, knoweth abſolutely what is beſt, the action followeth immediately (as farre as dependeth of the vnderſtanding) without any further diſpoſition on his behalfe: for ſeeing that nothing but knowledge belongeth to the vnderſtanding, he who ſuppoſeth all knowledge in it, alloweth all that is requiſite or poſſible for it to worke by: now if all be put, nothing is wanting that should cauſe it to worke: but where no cauſe is wanting, but all requiſite cauſes are actually being, the effect muſt alſo actually be, and follow immediately out of them: and conſequently, the action is done, (in as much as concerneth the vnderſtanding, and indeede abſolutely, vnleſſe ſome other cauſe do faile) as ſoone as the vnderſtanding knoweth all the circumſtances belonging to it: ſo as it is manifeſt out of this whole diſcourſe, that if a man wrought only by his vnderſtanding, all his actions would be diſcreete and rationall, in reſpect of the end he had propoſed to himſelfe; and till he were aſſured what were beſt, he would keepe himſelfe in ſuſpenſe and do nothing; and as ſoone as he were ſo, he would admitt of no delayes, but would at the inſtant proceede to action according to his knowledge: the contrary of all which, we dayly ſee by experience in euery man.

2. How our generall and inbred maximes doe concurre to humane actiō.

We may then ſafely conclude, that in humane nature there are two different centers, from whence croſſe actions do flow: the one he hath common with beaſts, and whoſe principles and lawes we deliuered in the former Treatiſe, where we diſcourſed of life, and the motions of life and of paſſions: the other is the ſubiect of our preſent enquiry; which in this place, expecteth at our handes, that we ſhould conſider how it demeaneth it ſelfe, and what it doth in vs, when by its guidance we proceede to any action. Experience muſt be our informer in generall: after which, our diſcourſe ſhall anatomiſe what that preſenteth vs in bulke. She giueth vs notice of three eſpeciall effects of our vnderſtāding:

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firſt, that it ordereth a right thoſe conceptions which are brought vnto it: ſecondly, that when they appeare to be not ſufficient for the intended worke, it caſteth about and ſeeketh out others: and thirdly, that it ſtrengthneth thoſe actions which ſpring from it; and keepeth them regular and firme and conſtant to their beginnings and principles. Vnto which laſt ſeemeth to belong, that it ſometimes checketh its owne thoughts, and bringeth backe thoſe it would haue, and appeareth to keepe as it were a watch ouer its owne wayes.

As for the ordering of the preſent notions, it is cleare that it is done by a ſecret dependance from the rules of diſcourſe, and from the maximes of humane action: I call this dependance a ſecret one, becauſe a man in his ordinary courſe, make th vſe of thoſe rules and *maximes* which ſerue his turne as though they were inſtilled into him by nature, without ſo much as euer thinking of them, or reflecting vpon them to ſquare out his actions by them: nay, ſome of them ſo farre out of the reach of moſt men, as they can not thinke of them, though they would; for they know them not: as in particular, the rules of diſcourſe; the vſe of which is ſo neceſſary, as without it no man can conuerſe with an other, nor do any thing like a man, that is, reaſonably. From whence then can this proceede, that ſo familiarly and readily a man maketh vſe of what he is not conſcious to himſelfe that he hath any acquaintance withall? It can be nothing elſe, but that the ſoule, being in her owne nature ordered to do the ſame thing, which ſchollers with much difficulty arriue to know what it is by reflection and ſtudy, and then frame rules of that afterwardes carry their diſcourſe to a higher pitch, she by an inborne vertue maketh a man do it orderly, conſtantly, and certainely.

3. That the rules and maximes of arts doe worke poſitiuely in vs though we thinke not of them.

The like may be obſerued in the dayly vſe men make of the *maximes* of humane action: which are certaine knowledges that formerly they haue gotten, but that they vſually thinke not of, whiles they worke agreeable to them; yet it ſeemeth they worke by them; for if their action ſhould iarre againſt any of them, they would preſently reflect vpon their *Maxime*, and by it correct what they were about: for example, one who is skilled in the rules of *Grammar*, or of accenting his ſpeech, or hath his eare vſed to *Muſike*, whiles he heareth true conſtruction, or euen verſe, or conſonant ſong, neuer reflecteth how it is made; or at moſt doth but conſider in groſſe, that it is right: but if a ſoleciſme, or falſe quantity, or diſcorde interuene, he preſently is aware, not only that it is amiſſe, but remembreth the very particular preciſe rule, againſt which the breach is made.

This at the firſt ſight might occaſion vs to imagine, that the rules by which any compoſition is made, do worke only negatiuely in vs, whiles we are buſie about it: that is, that they contribute nothing to the making of the thing, but only hinder vs from committing errors: but if we conſider the matter well, we ſhall find it impoſſible, but that they ſhould worke euen poſitiuely in vs; for we know that when we firſt

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learne any of these thinges, we looke industriously for such a gender, or number, or case, or tense, for such a foote or quantity, such a note, or consonance; and we are sure, that vse and practise of the same thing, doth not change, but only facilitate the worke: therefore it followeth of necessity, that we still vse those very instructions, by which at the first we could but slowly creepe, but now manage them with such celerity, as our fansy can not keepe pace with what we do. And this is the reasō why we do not perceiue that we thinke of them, but may peraduenture at the same time thinke of a quite different matter; as when a musitian playeth voluntary diuision vpon a ground he neuer saw before, and yet hath all the while some other thought in his head; or when a painter draweth a picture, and all the while discourseth with a by stander.

This truth may be conuinced by an other argument: as thus; it can not be doubted, but that a verse or song is made by the *power* of making such compositions: but that *power* is the art of them; and that art is nothing else but the rules whereby they are made: and accordingly we see, that who hath not the art, can not make such compositions: but who hath, can when he pleaseth: and if any man would be able to make them, he presently studyeth the art: so that it can not be doubted, but that artificiall thinges are alwayes made by the vse of those rules which teach the making of them; although for the most part we are not able to perceiue how such rules are vsed: and besides this, we are sure that we do not only make vse of those rules we learned at the first, but when we are arriued to Maistery in any art, we make vse of them in a quite different manner then we did in the beginning, and then we do in any other thing, wherein we find paine and difficulty.

4. How the vndestāding doth cast about when it wanteth sufficient grounds for action.

In the second effect that we experience of our vnderstanding, (which is, our casting about for new conceptions, when those it already hath, appeare not sufficient to direct what it hath in hand) the force and working of it, is very euident: for this effect proceedeth out of a want of satisfaction: and this belongeth properly to the vnderstanding; for if euidence and satisfaction be qualities of it, then of necessity the priuation of these qualities, must likewise belong vnto it; as also to discerne that priuation, and to vse meanes to auoyde it: and in the very casting about, we see a choice made; and that thinges are not taken promiscuously as they come of a rowe, but that some of them are sett aside, and others aduanced for vse: which argueth plainely the knowledge and gouernement of the vnderstanding.

5. How reason doth rule ouer sense and passion.

But the third operation, is that which giueth clearest euidence of the peculiar and distinct working of the vnderstanding: for if we marke the contestation and strife within vs, betweene our sensuall part and his antagonist which mainteneth the resolution sett by reason, and obserue how exceedingly their courses and proceedings differ from one an other; we shall more plainely discerne the nature, and power, and efficacy of both of them. We may perceiue that the motions against *Reason*, rise

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vp turbulently, as it were in billowes, and like a hill of boyling water (as truly *Passion* is a conglobation of spitits) do putt vs into an vnquiet and distempered heate and confusion: on the other side, *Reason* endeauoureth to keepe vs in our due temper, by sometimes commanding downe this growing sea; otherwhiles, by contenting in some measure the desires of it, and so diuerting an other way its vnruly force: sometimes she terrifyeth it, by the proposall of offensiue thinges ioyned vnto those it is so earnest to enioy: againe, sometimes she preuenteth it, by cutting of all the causes and helpes that promote on its impotent desires, and by engaging before hand the power of it in other thinges, and the like.

All which do euidently conuince, that as *Reason* hath a great strength and power in opposition of sense, so it must be a quite different thing, and of a contrary nature vnto it: we may adde, that the worke of *Reason* can neuer be well performed, but in a great quiet and tranquillity; whereas the motions of *Passion*, are alwayes accompanyed with disorder and perturbation: so as it appeareth manifestly, that the force of *Reason*, is not purely the force of its instruments, but the force of its instruments as they are guided, and as the quantities of them are proportioned by it: and this force of *Reason*, is different from the force of its instruments in themselues, in such sort as the force of a song, is different from the force of the same soundes, whereof it is composed, taken without that order which the musitian putteth in them: for otherwise the more spirits that are raysed by any thought (which spirits are the instruments whereby *Reason* performeth all her operations in vs) the more strongly *Reason* should worke; the contrary of which is euident, for we see that too great aboundance of spirits confoundeth *Reason*.

6. How we recall our thoughts from distractions.

This is as much as at present I intend to insist vpon, for proofe that our vnderstanding hath its proper and distinct operations, and worketh in a peculiar manner, and in a quite different straine from all that is done by our senses. Peraduenture some may conceiue, that the watchfulnesse and recalling of our thoughts backe to their enioyned worke, when they breake loose and runne astray, and our not letting them range abroad at randome, doth also conuince this assertion: but I confesse ingeniously, the testimony of it seemeth not cleare to me; and therefore I ranke it not with those, that I would haue (if it may be) solidely weighty, and vndenyable to who shall consider maturely the bottome and full efficaciousnesse of them. Of such, a few, or any one, is enough to settle ones mind in the beliefe of a truth: and I hope, that this which we haue laboured for in this Chapter, is so sufficiently proued, as we neede not make vp our euidence with number of testimonies.

But to shew the exceptions I take against this argument, lett vs examine, how this act within vs which we call watchfullnesse, is performed: truly, me thinke h it appeareth to be nothing else, but the promptitude and recourse of some spirits, that are proper for this effect,

which

which by a mans earneſtneſſe in his reſolutiõ, do take a ſtrõg impreſſion, and ſo are ſtill ready to knocke frequently at the dore of our vnderſtãding, and thereby enable it with power to recall our ſtrayed thougths. Nay, the very reflexion it ſelfe, which we make vpon our thoughts, ſeemeth vnto me to be only this, that the obiect beating vpon the fanſie, carryeth backe with it at its retiring from thence, ſome litle particle or atome of the braine or *Septum Lucidum*, againſt which it beateth, ſticking vpon it; in like manner as vpon an other occaſion, we inſtanced in a ball rebounding from a greene mudde wall, vnto which ſome of the matter of the wall muſt needes adhere: now this obiect, together with the addition it getteth by its ſtroake vpon the fanſie, rebounding thẽce, and hauing no more to do there at preſent, betaketh it ſelfe to reſt quietly in ſome cell it is diſpoſed into in the braine, as we haue deliuered at large in our former Treatiſe, where we diſcourſed of *Memory*: but whenſoeuer it is called for againe by the fanſie, or vpon any other occaſion returneth thither, it cometh as it were capped with this additional piece it acquired formerly in the fanſie; and ſo maketh a repreſentation of its owne hauing beene formerly there.

Yet, be theſe actions performed how they will, it can not be denyed, but that both of them are ſuch, as are not fitt, nor would be any wayes vſefull to creatures, that haue not the power of ordering their owne thoughts and fanſies, but are gouerned throughout meerely by an vniforme courſe of nature: which ordering of thoughts, being an operation feaſible only by rationall creatures, and by none others, theſe two actions (which would be in vaine, where ſuch ordering is not vſed) ſeeme to be ſpecially ordained by nature, for the ſeruice of *Reaſon* and of the *Vnderſtanding*; although peraduenture a preciſe proper working of the vnderſtanding, do not cleerely shine in it. Much leſſe can we by experience find among all the actions we haue hitherto ſpoken of, that our *Reaſon* or *Vnderſtanding* worketh ſingly and alone by it ſelfe, without the aſſiſtance and conſortshippe of the fantaſie: and as litle can I tell how go about to ſeeke any experience of it.

7. How reaſon is ſometimes ouercome by ſenſe and paſſion.

But what *Reaſon* may do in this particular, we shall hereafter enquire: and end this Chapter, with collecting out of what is ſaid, how it fareth with vs, when we do any thing againſt *Reaſon*, or againſt our owne knowledge. If this happen by ſurpriſe, it is plaine that the watch of *Reaſon* was not ſo ſtrong as it ſhould haue beene, to preuent the admittance or continuance of thoſe thoughts, which worke that transgreſſion. Againe, if it be occaſioned by *Paſsion*, it is euident that in this caſe, the multitude and violence of thoſe ſpirits which *Paſsion* ſendeth boyling vp to the fantaſie, is ſo great, as the other ſpirits, which are in the iuriſdiction and gouernement of *Reaſon*, are not able for the preſent to ballance them and ſtay their impetuoſity, whiles she maketh truth appeare. Sometimes we may obſerue, that *Reaſon* hath warning enough, to muſter together all her forces, to encounter, as it were in ſett

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battaile, the assault of some concupiscence, that sendeth his vnruly bandes to take possession of the fansie, and constraine it to serue their desires, and by it to bring *Reason* to their bente. Now if in this pitched field she loose the bridle, and be carryed away against her owne resolutions, and be forced like a captiue to obey the others lawes, it is cleare that her strength was not so great as the contrary factions.

The cause of which is euident; for we know that she can do nothing, but by the assistance of the spirits which inhabite the braine: now then it followeth, that if she haue not the command of those spirits which flocke thither, she must of necessity be carryed alõg by the streame of the greater and stronger multitude; which in our case, is the throng of those that are sent vp into the braine by the desired obiect; and they come thither so thicke and so forcibly, that they displace the others which fought vnder *Reasons* standard: which if they do totally, and excluding reasons party, do entirely possesse the fansie with their troupes, (as in maddenesse and in extremity of suddaine passion it happeneth) then must *Reason* wholy follow their sway, without any struggling at all against it; for whatsoeuer beateth on the fansie, occasioneth her to worke; and therefore when nothing beateth there but the messengers of some sensuall obiect, she can make no resistance to what they impose: but if it happen that these tumultuary ones, be not the only spirits which beate there, but that *Reason* hath likewise some vnder her iurisdiction, which keepe possession for her, though they be too weake to turne the others out of dores; then it is true, she can still direct fairely, how in that case a man should gouerne himselfe; but when he cometh to execute; he findeth his sinewes already possessed, and swelled with the contrary spirits: and they keeping out the smaller and weaker number, which reason hath ranked in order, and would furnish those partes withall, he is drawne euen against his iudgement and *Reason*, to obey their appetites, and to moue himselfe in prosecution of what they propose; in such sort as the Poet expresseth that Medea found in her selfe, when she complained and bemoaned her selfe in these wordes; *Video meliora proboque, Deteriora sequor*: and in this case, a man foreseeth his misery all the way he rouleth towardes it, and leapeth into the precipice with his eyes open: which sheweth that the army of thoughts on *Reasons* side, should be encreased in number, to haue her strong enough to wage battaile with the rebellious aduersary: or else, that her aduersary should be so much weakened, that she, though not growne stronger in her selfe, yet might, through the others enfeebling, be able to make her party good; (and hence is the vse of corporeall mortifications, to subiect our *Passions* to the beheast of *Reason*) euen as when we see, that when we are in health, our armes, and legges, and all our limbes, obey our will, reaching what we command them, and carrying vs whither we desire, because the spirits which are sent into them from our braine, are strong enough to raise and moue them as they are directed; but if our sinewes be so steeped

be ſo ſteeped in ſome cold and watry humour, that the ſpirits coming downe, find not meanes to ſwell and harden them; well we may wish and ſtriue, but all in vaine: for we shall not be able to make them performe their due functions. In like manner, if *reaſon* do ſend her emiſſaries into the ſame arme or legge or other member, and no other ſpirits do there ſtriue againſt them, then that limbe is moued and gouerned abſolutely according to her directions: but if at the ſame time, a greater multitude of others, do hinder *Reaſons* ſeruants from coming thither, or flocking into other ſinewes, do carry that limbe a contrary way; in vaine doth *Reaſon* ſtriue to moue them to her byas; for thoſe obeyng partes muſt obſerue the rules which the violent conquerour preſcribeth.

THE FIFT CHAPTER.

Containing proofes out of our ſingle apprehenſions, that our ſoule is incorporeall.

AS in our firſt Treatiſe we diſſected nature, and shewed, how out of the notion and firſt diuiſion of Quantity, ariſeth that vaſt multiplicity of thinges, which filling this world, falleth vnder the conſideration of our ſenſes: ſo in the beginning of this ſecond Treatiſe, we haue ſearched into thoſe operations of a man (attributed to his ſoule) by which he is conceiued to excell all other liuing creatures: and there diſcouered, that the admirable, and vnlimited variery of workes, which is ſeene in mens writinges and actions, doth all flow from the ſource of *ſingle apprehenſions*; and euen from one bare notion of *Being*: which is the roote and principle, from whence all others deriue their origine; and into which all may be reſolued; workes proceeding from reſolutions, they from diſcourſes, theſe being compoſed of iudgements, and iudgements of ſingle apprehenſions. This part we muſt now reuiew, and enquire what we can find in mans operation, arguing the *Quality* of his Soule, whether it be corporeall or no. For if theſe ſingle apprehenſions, and the proceſſes compounded of them, may be performed by the ordering of rare and denſe partes (as the other workes of nature are) then they will be corporeall, and of the ſame kind with thoſe, which we opened in the firſt Treatiſe: but if we shall proue, that they can not poſſibly be deduced from multiplicity, and order of Quantitatiue partes, then we may confidently reſolue ourſelues, that in the cauſe from which they flow, is a nature wholy diſcrepant from that which reſideth among bodies, and among corporeall thinges.

I. The cõnection of the ſubſequent Chapters with the precedent.

This we shall here labour to do: and to that end, we will beginne our worke with reflecting vpon what we haue deliuered of a ſingle apprehenſion, in the firſt Chapter of this ſecond Treatiſe: whoſe nature we there firſt explicated in common; and thence proceeded to ſome parti-

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cular apprehensions; and lastly shewed the extent they comprehended. These then must be the subiect of our present speculation.

2. The inexistēce of corporeall thinges in the soule by the power of apprehension, doth proue her to be immateriall.

As for their nature, we may remember, how we resolued three thinges: first, that by apprehension, the very thing apprehended is by it selfe in our soule: next, that the notion of *Being*, is the first of all notions, and is resumed in all others: and thirdly, that what is added to the notion of *Being*, is but *respects* to other thinges. Now then lett vs consider, what kind of engines they must be, that may haue the power to make thinges themselues to be in our soule, if they were to be there materially? How shall the place, or the time passed, be remoued, and be putt in an other place, and in an other time? How shall the quātity of the heauēs, of the whole world, nay of biggenesse exceeding all that by millions of proportionall encreases, be shutt vp in the litle circuite of mans braine? And yet if we examine our selues strictly, we shall find nothing wanting; all is there. How shall the same thing, be corporeally in two, nay in two thousand places, at the same time? And yet, in so many is the sunne, when two thousand men thinke of it at once. We must then allow, that thinges are there immaterially; and consequently, that what receiueth them, is immateriall: since euery thing is receiued according to the measure and nature of what receiueth it.

But I easily conceiue, that the strangenesse and incredibility of our position, may counterballance the force of it: for who can persuade himselfe, that the very thing he apprehendeth, is in his minde? I acknowledge, that if its being there, were to be vnderstood corporeally, it were impossible: but on the other side, who shall consider, that he knoweth the thing he rightly apprehendeth, that it worketh in him, and maketh him worke agreeable to its nature, and that all the properties and singularities of it may be displayed by what is in him, and are as it were vnfoulded in his mind, he can neyther deny nor doubt, but that it is there in an admirable and spirituall manner. If you aske me how this cometh to passe? And by what artifice, bodies are thus spiritualized? I cōfesse I shall not be able to satisfy you: but must answere, that it is done, I know not how, by the power of the soule: shew me a soule, and I will tell you how it worketh: but as we are sure there is a soule, (that is to say, a P*rinciple* from whēce these operatiōs spring) though we can not see it: so we may, and do certainely know, that this mystery is as we say; though because we vnderstand not the true and complete nature of a soule, we can as litle expresse the manner, how it is done by a soule. Yet, before we take our leaue of this matter of *Apprehensions*, we will in due place endeauour to say somethīg towardes the clearing of this obscure point.

3. The notion of *being*, which is innate in the soule, doth proue the same.

Our second consideration vpon the nature of *Apprehension*, was, that our primary and maine notion, is of *Being*. This discouereth some litle glympse of the nature of the soule: for it is manifest that she applyeth this notion, as well to no partes, as to partes: which we proued in the first Treatise, when we shewed that we haue a particular notion of *substance*, distinct

distinct from the notion of *Quantity*; for quantity and Partes being the same, it followeth that if there be a notion supposed by quantity, (as in substance there is) it must of necessity abstract from partes: and consequently, we may conclude, that the notion of *Being*, which is indifferently applyable eyther to quantity or to substance, doth of its owne nature wholy abstract eyther from *Partes*, or from no *Partes*. I then inferre: that since this notion of *Being*, is the very first and virgin notion our soule is imbued with or is capable of, and that it is the roote of all other notions, and into which she resolueth euery other notion, in such sort, as when we haue sifted and searsed the essence of any notion whatsoeuer, we can discouer nothing that is deeper then this, or precedent to it, and that it agreeth so completely with our soule, as she seemeth to be nothing else but *a capacity fitted to Being*: it can not be denyed, but that our soule must needes haue a very neere affinity and resẽblance of nature with it: but it is euident, that *Being* hath not of it selfe any partes in it, nor of it selfe is capable of diuision: and therefore it is as euident, that the soule, which is framed (as it were) by that patterne and Idea, and is fitted for *Being* as for its end, must also of it selfe be voyde of partes, and be incapable of diuisiõ. For how can partes be fitted to an indiuisible thing? And how can two such different natures euer meete porportionably?

If it be obiected, that the very notion of *Being*, from whence we estimate the nature of the soule, is accommodable to partes: as for example, we see that substance is endewed with quantity. We answere, that euen this doth corroborate our proofe: for seing that the substances, which our senses are acquainted withall, haue partes, and can not be without partes; and yet neuertheless in our soule, the notion of such substance is found without partes; it is cleare, that such substance hath this meerely from our soule: and because it hath this indiuisibility from our soule, it followeth that our soule hath a power and nature to bestow indiuisibility vpon what cometh into her. And since it can not be denyed, but that if any substance were once existent without partes, it could neuer after haue partes; it is euident, that the nature of the soule is incapable of partes; because it is existent without partes. And that it is in such sort existent, is cleare: for this effect of the soules giuing indiuisibility vnto what she receiueth into her, proceedeth from her as she is existent. Now since this notion of *Being*, is of all others the first and originall notion that is in the soule, it must needes aboue all others, sauour most of the proper and genuine nature of the soule: in which, and by which, it is what it is, and hath its indiuisibility.

If then it be pressed; how can substance (in reality or in thinges) be accommodated vnto Quantity, seing that of it selfe it is indiuisible? We answere, that such substance, as is the subiect of *Quantity*, and that hath *Quantity*, is not indiuisible; for such substance can not be subsistent without *Quantity*; and when we frame a notion of it, as being *indiuisible*, it is an effect of the force of our soule, that is able to draw a notion out

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of a thing that hath partes, without drawing the notion of the partes: which sheweth manifestly, that in her there is a power aboue hauing of partes: which being in her, argueth her existence to be such.

4. The same is proued by the notion of *respects*.

Our last consideration vpon the nature of apprehension, was, how all that is added to the notion of *Being*, is nothing else but *respects* of one thing to an other; and how by these *respects*, all the thinges of the world come to be in our soule. The euidēce we may draw from hence of our soules immateriality, will be not a whitt lesse, then eyther of the two former: for lett vs cast our lookes ouer all that cometh into our senses, and see if from one end to an other, we can meete with such a thing as we call a *respect*: it hath neyther figure, nor colour, nor smell, nor motion, nor tast, nor touch; it hath no similitude to be drawne out of by meanes of our senses: to be *like*, to be *halfe*, to be *cause*, or *effect*, what is it? The thinges (indeed) that are so, haue their resemblances and pictures; but which way should a painter go about to draw a *likenesse*? Or to paint a *halfe*, or a *cause*, or an *effect*? If we haue any vnderstanding, we can not choose but vnderstand, that these notions are extremely different, from whatsoeuer cometh in vnto vs by the mediation of our senses: and then if we reflect, how the whole negotiation of our vnderstanding is *in*, and *by respects*; must it not follow necessarily, that our soule is of an extreme different nature from our senses, and from our Imagination? Nay, if we looke well into this argument, we shall see, that whereas Aristotle pretendeth, that *Nihil est in intellectu quod non prius fuit in sensu*; this Maxime is so farre from being true, (in rigour of the wordes) that the quite contrary followeth vndenyably out of it; to witt, that *Nihil est in intellectu quod fuit prius in sensu*. Which I do not say to contradict Aristotle (for his wordes are true in the meaning he spoke them;) but to shew, how thinges are so much changed by coming into the vnderstanding and into the soule, that although on the one side, they be the very same thinges, yet on the other side there remaineth no likenesse at all between them in themselues as they are in the vnderstanding; which is a most euident proofe, (when the weight of it is duely considered) that the nature of our soule, is mainely different from the nature of all corporeall thinges, that come into our sense.

5. That corporeall thinges are spiritualized in the vnderstanding by meanes of the soules working in and by respects.

By this which we now come from declaring, the admiration, how corporeall thinges can be in the soule, and how they are spiritualized by their being so, will in part be taken away: for reflecting that all the notiōs of the soule, are nothing but the generall notion of a *substance*, or of a *thing* ioyned with some particular *respect*; if then we consider, that the respects may be so ordered, that one respect may be included in an other, we shall see, that there may be some one respect, which may include all those respects that explicate the nature of some one thing: and in this case, the generall notion of a *thing* coupled with this respect, will containe all whatsoeuer is in the thing: as for example, the notion of a knife, *that it is a thing to cutt withall*, includeth (as we haue formerly declared)

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declared) all that belongeth vnto a knife. And thus you see, how that mysticall phrase, of corporeall thinges being spiritualized in the soule, signifyeth no more, but that the similitudes which are of them in the soule, are *Respects*.

Thus hauing collected out of the nature of *Apprehension* in common, as much as we conceiue needefull in this place to proue our assertion, our next worke must be, to try if we can do the like, by reflecting vpon particular *apprehensions*. We considered them of two sortes, calling one kind, *vniuersall* ones; and the other, *collective* ones: in the *vniuersall* ones, we tooke notice of two conditions, the *abstraction*, and the *vniuersality* of them: now truly if we had no other euidence, but what will rise from the first of these, that alone would conuince and carry the conclusion: for though among corporeall thinges, the same may be now in one place, now in an other, or sometimes haue one figure, sometimes an other, and still be the same thinges, as for example waxe or water; yet, it is impossible to imagine any bodily thing whatsoeuer, to be at any time without all kind of figure, or without any place at all, or indifferent to this or to that: and neuertheless, all thinges whatsoeuer, when they are vniuersally apprehended by the soule, haue this condition in her by reason of their abstraction there, which in themselues is impossible vnto them. When we say water, fire, gold, siluer, bread &c: do we meane or expresse any determinate figure? If we do, none but that precise figure, will serue or content vs: but it is euident, that of a hundred different ones, any and euery one doth a like entirely satisfy vs: when we call for money, if we reflect vpon our fansy, peraduenture we shall find there a purse of crownes: neuertheless, if our messenger bringes vs a purse of pistoles, we shall not except against it, as not being what we intended in our mind, because it is not that which was painted in our fansie: it is therefore euident, that our meaning and our fansie were different; for otherwise, nothing would haue satisfyed vs, but that which was in our fansy. Likewise, in the very word (which is the picture of our notion) we see an indifferency; for no dictionary will tell vs, that this word *Money* doth not signify as well pistoles as crownes: and accordingly we see, that if our meaning had beene precisely of crownes, we should haue blamed ourselues for not hauing named crownes, and not him that brought vs pistoles, when we spoke to him by the name of money: and therefore it is most cleare, that our vnderstanding or meaning is not fixed or determined to any one particular; but is equally indifferent to all: and consequently, that it can not be like any thing which entereth by the senses; and therefore not corporeall.

6. That the abstracting of notions from all particular and indiuiduall accidents, doth proue the immaterialitie of the soule.

The second cõdition of *Vniuersall Apprehensions*, is their *vniuersality*: which addeth vnto their abstractiõ, one admirable particularity, and it is, that they abstract in such sort, as to expresse at the same time euen the very thing they abstract from. How is it possible, that the same thing, can be, and not be in the same notion? Yet lett a man consider what he

7. That the vniuersalitie of abstracted notions doth proue the same.

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meaneth when he ſaith, *Euery man hath two eyes*; and he ſhall ſee that he expreſſeth nothing, whereby any one man is diſtinguished from an other: and yet the force of this word *Euery*, doth expreſſe that euery man is diſtinguished from an other; ſo that in truth, he expreſſeth particularity it ſelfe in common. Now, lett our ſmarteſt and ingenioueſt aduerſary, ſhew or imagine if he can, how this may be done in a picture, or in a ſtatue, or in any reſemblance of a body or bodily thing: but if he can not, lett him acknowledge an eminent, and ſingular propriety in the ſoule, that is able to do it.

Let vs reflect, that particularity in a body, is a collection of diuerſe qualities and circumſtances; as that it is white, of ſuch a figure, in ſuch a place, in ſuch a time, and an infinitude of ſuch like conditions, conglobated together: then, if our ſoule be a body, the expreſſion of the particularity of a body in the ſoule, muſt be a participation in her of ſuch a conglobation, or of ſuch thinges conglobated. Now lett vs imagine if we can, how ſuch a participation ſhould be in common, and ſhould abſtract from all colour, all place, and all thoſe thinges of which the conglobation conſiſteth: and yet we ſee, that in the ſoule this is done; and he who ſaith *Euery man*, doth not expreſſe any colour, place, or time; and neuertheleſſe he doth by ſaying ſo expreſſe, that in euery man there is a conglobation of colour, place, and time: for it could not be *Euery one*, vnleſſe there were ſuch conglobations to make *Euery one*, *one*: and if any conglobation were expreſſed in this terme *Euery one*, it would not be *Euery one*, but only *one alone*. Now if any coordination of partes, can vnfould and lay open this riddle, I will renounce all Philoſophy and vnderſtanding.

8. That collectiue apprehenſions do proue the ſame.

Collectiue apprehenſions will afford vs no meaner teſtimony then the other two, for the ſpirituality of our ſoule: for although it may ſeeme vnto vs, before we reflect throughly on the matter, that we ſee, or otherwiſe diſcerne by our ſenſe, the numbers of thinges; as that the men in the next roome, are three; that the chaires there, are tenne; and the like of other thinges; yet after due conſideration, we ſhall find, that our eye, or ſenſe telleth vs but ſingly of each one, that it is *one*; and ſo runneth ouer euery one of them; keeping them ſtill each by themſelues, vnder their owne ſeuerall *vnities*: but then the vnderſtanding cometh, and ioyneth vnder one notion, what the ſenſe kept a ſunder in ſo many ſeuerall ones, as there are *thinges*. The notion of *three*, or of *tẽne*, is not in the *thinges*, but in our mind; for why three rather then fiue, or tẽne rather then twelue, if the matter of which we ſpeake were not determined? and ſuch determination of the matter, is an effect of the vnderſtanding. If I had ſpoken of *thinges*, as I did of men, or of chaires, there had beene more then three or tenne: it is then euident, that what determined my ſpeech, made the number be three or tenne.

Againe, we ſee that the notion of *tenne*, is but one notion; for as the name of tenne, is but one ſigne, ſo it argueth, that there is but one notion,

notion, by which it is the ſigne of tenne thinges. Beſides, we ſee that Arithmetitians do find out the proprieties and particular nature of any determinate number: and therefore we may conclude, that euery number hath a definition, and a peculiar nature of its owne, as it is a number. If then this definition, or nature, or notion of *tenne*, be a corporeall one, it is a corporeall ſimilitude of the obiect. But is it like to any one of the thinges, or is it like to all the tenne? If to any one, then that one will be tenne; if it be like to the whole made of tenne, then that whole being but one, tenne will be iuſt one, and not tenne thinges.

Beſides, to be *tenne*, doth expreſſely imply to be *not one*: how then can that be a materiall thing, which by being one repreſenteth many? Seeing that in materiall thinges, *one* and *many* are oppoſite, and exclude one an other from the ſame ſubiect? And yet, this notion could not repreſent many together, but by being one.

Againe, if it be a materiall notion or ſimilitude, it is eyther in an indiuiſible of the braine, or it is in a diuiſible part of it: I meane, that the whole eſſence of the notion be in euery part neuer ſo litle of the braine, or that one part of the eſſence, be in one part of the braine, and that an other part of the eſſence, be in an other part of the braine. If you ſay, that the whole eſſence is in euery part of the braine, though neuer ſo litle; you make it impoſſible that it ſhould be a body; for you make it the likeneſſe of tenne determinate bodies, in an indiuiſible māner; ſeeing that what by diuiſion groweth not leſſe, hath the nature of an indiuiſible: but if you ſay, that diuers partes of the eſſence, are in diuers partes of the braine, then you make it impoſſible that the notion of tenne, ſhould be indiuiſible; ſince it ſelfe is compoſed of ſeuerall partes.

In a word, tenne thinges can not be repreſented materially, but by tenne other things: and therefore it is moſt euident, that the ſoule which repreſenteth tenne by one thing or notion, doth not repreſent the tenne materially: and conſequently, that her ſelfe is immateriall.

What we haue now ſaid, will be confirmed by conſidering the termes, *All* and *whole*: for it is cleare, that theſe termes alſo, are of the nature of numbers; but withall, do expreſſe particularly that no part is wanting. If then the notion of *All* or *whole*, be ſaid to be materiall and quantitatiue, it muſt be diuiſible: but if you diuide it, no part remayneth *All* or *whole*: it is not therefore diuiſible; and conſequently it is not materiall. And as this argument, is manifeſtly applyable to numbers, ſo if we looke into the arguments concerning numbers, you will find all them likewiſe applyable to theſe termes, *All* and *whole*.

9.

The operations of the ſoule drawing allways from multitude to vnitie, do proue the ſame.

Out of what hath beene hitherto diſcouered, we may gather this note: that it is the nature of the ſoule, to draw from diuiſibility, to indiuiſibility; from multitude, to vnity; from indeterminateneſſe and confuſion, to a clarity and determination: as appeareth euidently in this laſt example of *Collections*; in which, whether we take numbers, or other

collectiue termes, wee see that throughout their natures do consist in such a perfect indiuisibility, as no part can be seperated without destroying the essence of the notion: nay, thinges which in themselues are many and consist in partes, do in the mind gett an impartible nature; for *tenne*, is no longer *tenne*, if it be diuided: nor *all*, is *all*, if any thing be taken away. In the same manner, though Philosophy teach vs, there be neyther pointes in biggenesse, nor instantes in motion or time, yet nature maketh vs expresse all biggenesse by pointes, and all time by instantes; the soule euer fixing it selfe vpon indiuisibility.

And this is the reason, why we attribute the nature of substance to all our notions: if we see a thing white, or blacke, or doe, or suffer, or be in a place, or in time; presently in our apprehēnsion we conceiue these modifications of the thing, like substances; and accordingly we call them by substantiue names, *Whiteneſſe*, *Action*, *Vbication*, *Duration*, &c: now the reason of this is, because a substance, (that is terminated within it selfe) is a fitt and a steady ground for the soule to fixe it selfe vpon, whereas these other Appendixes of substance, would not afford her easy footing to build her structures vpon, if she considered them as truly they are in themselues: and therefore in her notion, she giueth them the qualities of substance: but withall it happeneth many times, that by her doing thus, if she be not very wary, she is deceiued and falleth into grosse errours.

10. The difference betwixt the notion of a thing in our vnderstanding, and the impression that correspondeth to the same thing in our fansie, doth proue the same.

One thing more we must remember to take notice of; and it is, that if we will compare the notions in our vnderstanding, with the *signes* which beating in our fansie do begett those notions; we shall find, that these are but barely signes; and do not in their owne nature expresse, eyther the notions they raise, or the thinges they are signes of. This is euident in the images of the soundes we call *wordes*: for it is cleare, they haue no likenesse eyther with the thinges they signify, or with the thoughts they begett in vs: and we shall find it no lesse true of other images; for example, in the exteriour impressions of sensible *qualities*, which seeme by themselues to be in the vnderstanding; for if we consider the matter well, we shall perceiue that we vnderstand nothing more by them, then we do by meere wordes; and that to worke, or to discourse out of them, we must seeke into the obiects, and their definitions; whereof we learne nothing by those first impressions: for it seemeth, that (for exāple) hoat, or red, or sweete, to a man that first seeth, or feeleth, or tasteth them, signifyeth nothing else, but a thing which maketh such an apprehension in his soule, or such a phantasme in his interiour sēse; and neuertheless, as yet the mā knoweth not that he hath a soule, or an interiour sense; nor doth reflect so farre as to consider, that this motion passeth by his exteriour sense; but his apprehension is immediately carried to the thing without him; and he imagineth that the impression he feeleth, is in the thing he feeleth; and so he that should feele himselfe heated by a burning glasse, and were not acquainted with the vertue of such a glasse, would thinke the glasse were hoat: yet certainely, his first

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his first apprehension is of the motion made in his fansie, (though he imagineth it elsewhere) which he conceiueth to be the nature of the thing that maketh it. And thus we see that the conuersion of the soule, is immediate to a thing without the man : which also is the effect of her being fixed to *Existence*; for by reason of that, she still apprehendeth euery impression as a *thing*.

But now, whether her apprehension doth include the very impression, which is in the sense or in the fansie, so that by its owne likenesse it be in the soule, or whether the impression in the fansie maketh a change in the soule, which we can not discerne in it selfe, but conceiue it to be the impression which is in the fansie, because that impression is at the first continually present at the said mutation; is more obscure and hard to discouer. But when we reflect that after some time, wordes do succeed in lieu of this impression, and do performe the same effect as the originall impression, in what language soeuer they be vttered, so they be vnderstood; we may conclude out of this euident signe, that the impression is in the vnderstanding not in its owne likenesse, but in an other shape, which we do not discouer; and which is excitated, as well by the name, as by the impression, in a man that is vsed to the names.

Againe, in a man that learneth thinges by himselfe, these impressions serue for wordes, and not for thinges; for such a man neuer looketh into his fansie to discourse vpon any thing, but only vpon the mutation he conceiueth is made in the externe sense: out of which he gathereth by litle and litle, the nature of the thing, whose notion was made at first in him by this impression. Out of which it is manifest, that our knowledge is as different a thing, from the Phantasmes which beate at the soules dore, as the thing signifyed is from the sound of the word, or as the wine in the cellar is from the bush: and therefore, it is impossible that the soule (in which that knowledge resideth, and which indeede is that knowledge) should be a corporeall or bodily thing: since of all bodily thinges, the motions that are made by the sensible qualities, arriue neerest to a spirituall nature.

11. The apprehensiō of negatiōs and priuations do proue the same.

It remayneth now, that we should argue for the immateriality of the soule, out of the extent of our *apprehension*: which seemeth to be so excessiue, as not to be comprehensible by the limitations of bodies; and therefore can not belong vnto a body: but because all that needeth to be said in this particular, followeth plainely out of groundes already vrged, and that this point containeth not any notable particularity deseruing mention here; we will not enlarge ourselues any further vpon it: but will passe on to the next line of operations proper vnto our mind.

Only we may not omitt taking notice of the expressions which our mind maketh of *nothing*, or as Logitians terme it, of *Negations* and *Priuations*: which do argue an admirable power in the soule, and of a quite different straine from all corporeall thinges; and do euidently conuince the immateriality of it: for it can not be doubted, but that the

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ſoule knoweth what she meaneth, when she diſcourſeth of *Nothing*. Now if all her knowledge, were nothing elſe but corporeall phantaſmes, or pictures made by corporeall thinges, how should she come to haue a notion of *Nothing*? for ſince it is moſt cleare, that *ſomething* can not be like *Nothing*, and that there can not be a participation of what *is not*; how can we conceiue that there should be a ſimilitude made of *Nothing*?

The way therefore that the ſoule taketh in this operation, is, that comparing two thinges together, and finding that the one of them is not the other; she reflecteth vpon her owne action, and diuiding in it the thing ſaid, from the ſaying, she taketh the thing ſaid for a quality, or property, or predicate (as Logitians call it) of that thing which she denyeth to be the other thing; and then she giueth it a poſitiue name, after she hath firſt made a poſitiue notion, vnto which the name may agree: as for example, when the ſoule conſidereth a man that hath not the power to ſee, as ſoone as she hath to her ſelfe pronunced, that he hath not ſuch a power, she taketh the *not power to ſee*, for a quality of that man; and then giueth the name of *blindeneſſe* to that *not power of ſeeing*; which though of it ſelfe it be nothing, yet by being that which ſatisfyeth her act, whē she ſayeth that he hath not the power of ſeeing, it ſeemeth to be ranked among thoſe thinges, vnto which names are due: for it hath a notion; and the hauing a notion, is the clayme, or merite; or dignity, in vertue whereof thinges are preferred to names.

Now then, lett vs enquire how the power of rarity and denſity, or the multiplication and order of partes, can be raiſed and refined to the ſtate of being like *nothing*, or of being the ſimilitude of a *negation*; or what operation of rarity ad denſity, can forge out this notion of *blindeneſſe*, which we haue explicated: and when we find, it is beyond their reach to compaſſe, we muſt acknowledge, that the ſoule is an other kind of engine, then all thoſe which are in the ſtorehouſe of bodies.

THE SIXT CHAPTER.

Containing proofes out of our ſoules operations in knowing or deeming any thing, that she is of a ſpirituall nature.

1. The manner of iudging or deeming by apprehending two thinges to be identified, doth proue the ſoule to be immateriall.

OVr next conſideration shall be to ſee what teſtimony our manner of *Iudging*, doth yield vs of the nature of the ſoule: concerning which, three thinges offer themſelues, worthy the reflecting on; which are, our manner of thinking; the oppoſition which frequently occurreth in our thoughts; and the nature of truth and of falſehood. As for the firſt, we may remember how we haue shewed, that all *iudgement* or *deeming* is but an apprehenſion of identification, or ſomething immediately following

following out of it: and that a settled *iudgement* or *assent of the mind* is as it were a limbe, or branch, or graft in our soule; so that we find that our perceiuing of identification between two thinges, or our seeing that the one is the other, is that by which our soule encreaseth. Now, because when two thinges are identifyed, the one reacheth not further then the other, it is cleare that this encrease of the soule is not made by partes, which being added one to an other do cause it to be greater: and therefore, since this latter course is the only meanes of encrease in bodies and in quantity, it is as cleare that the nature of the soule, is quite different from the nature of all corporeall or Quantitatiue thinges.

Againe, it is against the nature of identification, to be of partes; and therefore, they who take quantity to be one thing, and not many thinges tyed together, do acknowledge that truly there are no partes in it: and this is so rigorously true, that although we speake of two thinges that in reality are identifyed one with an other, yet if our wordes be such, as imply that our vnderstanding considereth them as distinct partes, and by abstraction giueth them the nature of partes; then they are no longer identifyed, but in good Logike, we ought in this case to deny the one of the other. As for example: though the hand and the foote be the same thing, (as we haue declared in our first Treatise) yet because in the name *hand*, there is a secret exclusion of any thing that is not in the definition of a hand: it followeth that in our speech we must say, that a hand is not a foote. Likewise though it be confessed, that the thing which is *rationality* is also *risibility*; neuertheless, it is a soleciſme in Logike, to say that *rationality* is *risibility*; because it is the nature of these abstracted names, to confine their signifycations to one definition; and the definitions of these two termes are diuers. Out of this consideration it followeth clearely, that seeing the nature of partes, is contrary to the nature of identity; and that the soule in her iudgements worketh altogether by identity, it is impossible that her operations should consist of partes, or in any sort resemble any proceeding of Quantitatiue thinges.

2. The same is proued by the manner of apprehending opposition in a negatiue iudgement.

The like will be conuinced out of the opposition we find in our thoughts. In it we may consider two thinges: first the generation of it: next, the incompossibility of opposites in the soule. To beginne with the first: we see that in our speaking, opposition is produced by the addition of this word *Not*: as when we say, *not a man*, *not a penny*, *not a word*; and therefore it followeth, that in our soule there is a notion of it, correspondent to the word that expresseth it. Now, seeing that a notion is a thing, and that it is the likenesse of its obiect, or rather the same with the obiect; lett vs cast about, how we should of partes and of Quantity, make a *nothing*, or an identification to *not*: and when we find that it is ridiculous and absurd to go about it, lett vs conclude, that the manner of working, which our soule vseth, is farre different from that which is vsed in bodies, and among materiall thinges.

And if you obiect, that not only a body, but euen any other substance

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whatsoeuer (suppose it as spirituall as you will) can not be eyther like, or identifyed to *nothing*; and therefore this argument will as well proue that the soule is not a thing or substance, as that it is not a body: we answere, that it is euident out of what we haue already said, that the vnderstanding is not the obiects it vnderstandeth, by way of similitude, but by a higher meanes; which we haue shewed to be by way of *Respects*. Now then, the respect which a thing hath to an other thing, by not hauing such a respect vnto it, as a third thing formerly considered hath therevnto, may be expressed in way of *Respects*, though it can not in way of similitude: and so our vnderstanding is able to expresse, what neyther our fansy, nor any corporeall thing can arriue to the expression of: as when first we find, that one man hath a respect to the wall, which we call the power of seeing, it if afterwardes we find that an other man hath a respect vnto the wall of impotence, that he can not see it, this second respect the vnderstanding hath a power to expresse as well as the first: as we haue touched aboue.

3. That thinges in themselues opposite to one an other hauing no opposition in the soule, doth proue the same.

As for the opposition that occurreth in our thoughts, we may consider it of two kindes: the one is of the thinges or obiects that come into our thoughts or into our soule: and this is not properly an opposition in the soule; for although the thinges be oppositeby their owne nature in themselues, yet they do not exercise their opposition in the soule: nay, though the oppositiō be euen in the soule it selfe, if the soule with this oppositiō, be considered as an obiect, it maketh no opposition in the soule; for so you may consider your soule learned and vnlearned, ignorant and knowing, good and bad, and the like: all which are oppositions in a soule supposed to be so qualifyed, but are no oppositions in a soule that considereth them: no more then fire and water, heauy thinges and light, white and blacke, being and not being, an affirmatiue proposition and its negatiue, and the like: all which are in themselues so contrary and opposite to one an other, that they can not consist together in one subiect; they haue an incompossibility among themselues; whereseoeuer the one of them is, by its very entrance it drieth out its opposite: and yet in the soule they agree together without reluctance: she knoweth and considereth and weigheth both sides of the scale at the same time, and ballanceth them euenly one against an other: for vnlesse both the opposites were in the same instant in the same comparing power, that power could not by one act whose beginning implyeth its ending, iudge the difference and opposition of them: as when we say *blacke is contrary to white*, or *darkenesse is the want of light*, we pronounce one common *not being* of both exrremes.

We may then boldely conclude, that since no body whatsoeuer can entertaine at the same time, and in the same place, these quarrelling Antagonistes, but that by their conflict, they presently destroy one an other, and peraduenture the body too, into which they presse for entrance, and the entire possession of which each of them striueth

ſtriueth for; (thoſe of them I meane, that are proportioned to the reception of bodies) and that the ſoule imbibeth them together without any difficulty or contraſt, and preſerueth them allwayes frendes euen in the face of one an other, and lodgeth them together in the ſame bed; and that (in a word) theſe oppoſite thinges do enioy an admirable and vnknowne manner of *Being* in the ſoule, and which hath no parallele nor argument in bodily thinges: we may (I ſay) boldely conclude, that the ſoule it ſelfe, in which all theſe are, is of a nature, and hath a manner of *Being* altogether vnlike the nature of bodies, and their manner of *Being*.

4. That the firſt truthes are identified to the ſoule.

Out of this agreeing of all obiects in the ſoule, and their hauing no oppoſition there, euen whiles she knoweth the oppoſition that is betweene them in themſelues, there followeth an other conſideration, of no leſſe importance: which is, that the amplitude of our ſoule in reſpect of knowledge, is abſolutely infinite; that is to ſay, she is capable of knowing at the ſame time obiects without end or meaſure. For the explicating whereof, we are to cõſider, that the latter concluſions, which the ſoule gaineth knowledge of, do hang to the former by identificatiõ, or by the ſoules ſeeing that two notions are identifyed, becauſe they are identifyed to a third, as is before expreſſed; and the firſt principles which ſeeme to be immediately ioyned vnto the ſoule, haue the identity of their termes plaine and euident, euen in the very termes themſelues. Nay, if we inſiſt further, we ſhall find that the firſt truthes muſt haue an identification to the very ſoule it ſelfe; for it being euident that truth or falſhoode, is not in the ſoule but ſo farre forth, as she doth apply her ſelfe to the externall obiect, or to the exiſtence of thinges in themſelues; and that we find that the ſoules knowing with euidence that any thing *is* or *hath being*, implyeth her knowing that her ſelfe *is*; (for she can not know that a thing ſeemeth ſo to her, or maketh ſuch an impreſſion in her, without knowing that her ſelfe *is*; though peraduenture she may not know what her ſelfe is, but taketh her ſelfe to be no other thing then the body of the man in which she is) it is euident that the firſt truthes which enter into the ſoule, to witt, that this or that ſeemeth ſo or ſo vnto her, (and theſe truthes no ſceptike euer doubted of) are identifyed with the ſoule it ſelfe; ſeeing that an obiects ſeeming to be ſuch or ſuch, is nothing elſe, but the ſoule ſo qualifyed.

And by this we find, that the certainty of the firſt *Principles*, as for example of this Propoſition, *That the whole is bigger then the Part*, will depend in a particular ſoule of her certainty of her owne *Being*: for although this propoſition would haue a neceſſity in the very connexion of the termes, notwithſtanding there were not in nature any *whole* or *Part*; yet this neceſſity would not be a neceſſity of *Exiſtence* or of *Being* in the obiect, but a neceſſity of connexion, as it were of two partes of the ſoule: and ſo, if verity and falſity be not perfectly in the ſoule, but in compariſon to actuall exiſtence, the ſoule would not be perfectly true, or

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(to say more properly) would not haue the perfection of truth in her, by hauing or knowing this proposition, vnlesse withall she were certaine, that there were existēt, an obiect of this Propositiō: of which (as we haue said) she can not be certaine, without being certaine of her owne *Being*; so that in effect, the identification of other thinges among themselues, by which such thinges are knowne, doth come at the last to be retriued in the existence of the soule it selfe, and to be in the soule, by the identification of those other thinges vnto her selfe.

5. That the soule hath an infinite capacitie, and consequently is immateriall.

Now then to proceed to the proofe of our proposed conclusion, it is cleare, that the adding of one thing to an other, doth out of the force of this addition, perfect the thing vnto which the addition is made, if the aduenient thing be added in such way, as the former is apt to receiue it: but it is euident, that the soule is made fitt by former propositions, to be identifyed to later ones; for we see that the former ones draw on, and inferre the later ones: and therefore it followeth, that the more is added to the soule, the greater is her aptitude to haue more, or to be more encreased: and consequently, that the more is added vnto her, the more may still be added; and the more capable and more earnest she is, to haue more. Wherefore it can not be denyed, but that since in the nature of the obiects there is no impediment to hinder their being together in the soule, (as we haue proued a litle aboue) and that in her by receiuing new obiects into her, there is a continuall encrease of capacity to receiue more; she hath an amplitude to knowledge absolutely infinite, in such a manner as we haue aboue expressed.

Now to apply to our purpose what we haue gathered by this discourse, it is cleare, that these two conditions of *one thing not driuing out an other*, and of *infinity of accessions*, do openly disclayme from quantity, and from matter; for we see that what hath Quantity, or is a Body, can not admitt a new thing into it, vnlesse some other thing do first go out of it, to make roome for the aduenient one: and as for infinitude, it breedeth a sea of contradictions, if it be but thought of in Quantity: and therefore we may conclude, that the soule, vnto whom these two conditions do belong, is not quantitatiue or corporeall, but immateriall, and of a spirituall nature.

6. That the opposition of contradictory propositions in the Soule doth proue her immaterialitie.

The second kind of opposition, that occurreth in our thoughts, or in our soule, is of *Contradictory Propositions*: it hath its origine in the opposition of *Being* to not *Being*: and is when a thing is identifyed vnto the soule, in such sort as we haue said, that a *Iudgement* or *Deeming* maketh the obiect become as it were a limbe, or part of the soule: and because the conflict of two such propositions, if they were together in the soule, would make her be something contrary to the nature of *Being* (if any thing can *be* contrary to *Being*) which in the schooles they call *ens & non ens*; the impossibility of her admitting into her selfe two such propositions together, doth testify her firme cleauing and her fixednesse to *Being*: and so doth confirme and bring new euidence to that argument

argument for the soules spirituality, which in the first Chapter of this part, we drew from the nature of *Being*.

As for truth and falsehood, they spring from the same roote as the last; as being qualities consequent to the opposition of affirmatiue and negatiue propositions; whereof if the one be true, the other must necessarily be false: and therefore, we neede not spend time in setting downe any particular considerations of these; since what we haue said of the other, is applyable vnto them: but it is sufficient, that we thus note them, to giue the Reader occasion to reflect vpon them.

7. How propositions of *eternall truth*, do proue the immateriality of the soule.

Among propositions, there are some which Logitians do terme *of Eternall truth*: and out of these, there are ingenious men, who imagine that the Immortality of the soule may be immediately deduced. Herein they roue not quite from the marke; though withall I must needes say, they do not directly hitt it. To vnderstand the vtmost that may be inferred out of such propositions, we may note two conditions in them: the first is, that generally these propositions are vniuersall ones; and thereby haue that force to conuince the spirituality of the soule, which we haue explicated and shewed to belong vnto vniuersall termes: the second is, that in these propositions, there is a necessity of connexion between their termes; such an one, or at the least very like therevnto, as we explicated in those propositions, which beare their euidence plaine in their very termes. And out of this we may draw an other argument for the spirituality of the soule: for we see that all corporeall agents and patients, are defectible and contingent; that is to say, sometimes, or (if you will) most times, they attaine their effect; but withall, sometimes (be it neuer so seldome) they misse of it: and accordingly, it happeneth sometimes that our eyes, our eares, our touch, and the rest of our senses are deceiued; though for the most part, they giue vs true informations of what they conuerse with: but these propositions of eternall verity do neuer faile: they haue in themselues an indefectibility insuperable; and consequently, they giue euidence that the soules nature is of a higher degree of constancy and certainty, then what falleth within the compasse of bodies: and is of a nobler and different straine, from all corporeall thinges: for this certainty is entayled vpon such propositions by the force of *Being*; which is the proper obiect of the soule: and they haue their *Being*, as limbes and partes of the soule.

As for the terme of *Eternall verity*, it is not to be taken positiuely, as if these propositions, or their obiects, had any true eternity or perseuerance, without beginning or ending: but only negatiuely; that is, that there can be no time, in which they are false: and therefore, we can not out of their hauing such a kind of Eternity belonging to them, argue a capacity of infinite time or duration in our soule that comprehendeth them.

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THE SEVENTH CHAPTER.

That our diſcourſing doth proue our ſoule to be incorporeall.

1. That in diſcourſing the ſoule cõtaineth more in it at the ſame time then is in the fantaſie, which prooueth her to be immateriall.

HAuing thus runne ouer thoſe proofes for the immateriality of our ſoule, which ariſe out of her manner of working when she iudgeth; in the next place, we are to enquire what others, her manner of diſcourſing will afford vs. We are ſure, that ſince our diſcourſe is compoſed of iudgements, and of ſingle apprehenſions, it can not chooſe but furniſh vs with all thoſe pregnant arguments, that we drew from them. But that will not ſerue our turne: we looke after new euidence; and we ſhall ſee it will giue it vs with full handes. It conſiſteth in this: that when we diſcourſe, we may eaſily perceiue there is more at one time in our minde, then we can diſcouer to be in our fantaſy; for we find, that in our fantaſy, as one propoſition cometh, an other is gone: and although they that are gone, ſeeme to be ready at a call, yet they are not in preſence; as being thinges which conſiſt in motion, and that require place; and therefore the one iuſtleth the other out of the place it poſſeſſed. But if it fared in like manner in our inward ſoule, we could neuer attaine vnto knowledge: for it is manifeſt, that our ſoule is not aſſured of a concluſion, but by her ſeeing the premiſſes: if then the premiſſes be taken away, the concluſion that reſteth vpon them, falleth to the ground: but they are taken away, if they be out of our mind: therefore, when our vnderſtanding yieldeth its aſſent to a concluſion, it muſt of neceſſity haue the premiſſes ſtill in it.

But we muſt not reſt here; this conſideration will carry vs on a wondrous deale further: we know, that who ſo goeth to frame a new demonſtration in any ſubiect, muſt be certaine he taketh nothing contrary to what he hath learned in many bookes: likewiſe, that who will make a latine verſe, or readeth a Poeme, knoweth there is nothing in all that Poeme contrary to his Proſodia: do we not then manifeſtly perceiue a certaine remainder of all theſe in his ſoule? The like is in all artes: in which he that goeth about any worke according to art, sheweth he hath in his head all the rules of that art, though he do not diſtinctly remember them, or call them to mind whiles he worketh: for if he haue them not, how doth he worke by them? Since then it is cleere that he thinketh not of them at that time, it is as cleere, that more is in his ſoule at one time, then is in his fantaſy, or then can be there by materiall bodies, (which we haue shewed is the way, whereby all thinges come into the fantaſy) although it be the nimbleſt and the ſubtileſt Agent of all corporeall thinges whatſoeuer.

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2. That the nature of discourse doth proue the soule to be ordered to infinite knowledge, and consequētly to be immateriall.

An other consideration whereby to euince the immateriality of the soule, concerneth the proceeding of syllogismes by linkes, fastened one to an other: whence we may take notice, that euery one of them is a steppe to an other: and consequently, it is manifest that according to the nature of the soule, they must be all together in her: since, if any one were absent, all the rest that followed and depended vpon that one, would haue no grounding, nor fixednesse in the soule. Now if to this we adde, that what is to be knowne, is absolutely and liquidly infinite, there can not be brought or expected a more pregnant and home witnesse of our soules spirituality: it following out of these groundes, that the soule by its nature, is not only capable of, but is expressely ordered to an infinite knowledge of infinite obiects all together; for these two, *finite* and *infinite* science, are so vastly different from one an other, that if the same subiect be capable of both, it must of necessity be ordered to infinite, as to its chiefest act and end: and thus out of *capacity* in this subiect, *its being ordered* is well inferred; though in other matters peraduenture the consequence may not be good. And accordingly, who looketh into *Geometry*, *Arithmetike*, *Logike*, or euen *nature* it selfe, will euidently see that the obiects of knowledge, are euery way, and in euery science, multiplyable without end.

3. That the most naturall obiects of the soule are immateriall, and consequently the soule her selfe is such.

Neyther ought this to be neglected, that a great part of the soules obiects, and indeed of those that are most naturall to her, is aboue the capacity, and out of the reach of materiall thinges. All Metaphysikes abstract frō quantity: the inuestigation of God, of Angels, of the soule it selfe, eyther concludeth immateriality, or at the least worketh about it. What shall I say of Logicall notions, of those which are called the *second intentions*; about which there is so much busines, both in the schooles and in the world? It is sufficient that we haue already expressed, how all our notions are *respective*. But in particular the motiues of humane actions are very abstracted considerations: as for example, hope of thinges to come, memory of thinges passed, vertue, vice, honour, shame, and the like. To these lett vs adde, that when we teach or explicate any thing to ignorant persons, we must frame our owne apprehensions to their capacity, and we must speake such thinges as they may comprehend: which capacity or extent of comprehension we can not see nor perceiue by any sense, but we iudge it meerely by our Reason, and by our vnderstanding. Wherefore, seeing that our operation is mainely and chiefely on and by such motiues, as are not lyable to materiall principles and compositions, it is euident, that the springhead from whence such an operation floweth, must also be immateriall and incorporeall.

I am not ignorant, that this argument vseth to be answered by vrging, that the soule likewise knoweth *Deafenesse*, *Dumbenesse*, *Blindenesse*, and such other notions of *Nothinges*; and yet is not from thence inferred to be *nothing*: it conceiueth God and Eternity; and yet it is neither from it selfe, as God is, nor eternall. In like manner (say they) it

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may know incorporeall thinges, and yet not be therefore it selfe incorporeall. To this I reply, first with wishing them not to mistake me, but to giue my argument its full force and weight: for there is a very great difference betweene the knowing of a thing, in a strained, toylesome, and confused manner, and the hauing a thing for its ordinary matter and subiect of negotiation: this argueth connaturality between the soule and what it is in such sort conuersant about; but that doth not. Now, what is inferred out of whole sciences and artes, concerneth a maine stocke of the soules businesse, and not some extraordinary vertue or power she hath.

But to come vp close to the answere: I say, that if we being throughly acquainted with materiall thinges, can find that it is not in the possibility of any such to be the likenesse of an immateriall thing; and from thence do inferre that our soule, for being fraught with immateriall notions, is not materiall; our conclusion is well collected, and a very good one; for the premisses out of which we do gather it, are within our kenning; and therefore if there were any defect in the consequence, we should easily perceiue it. Whence it appeareth clearely, that there is no parity between the deduction of our conclusion, and that other which the obiection vrgeth, that our soule, because it can know eternall thinges, is also eternall; for eternity is a thing beyond our comprehension: and therefore it ought not be expected at our handes, that we should be able to giue an account where the bracke is. And to say the truth, if *knowledge* be taken properly, we do not know eternity; howeuer by supernaturall helpes we may come to know it: but in that case, the helpes are likely to be proportionable to the effect. Neyther are negations properly knowne, seeing there is nothing to be knowne of them. And thus we see that these obiections do proceed from the æquivocation of the word *knowledge*; sometimes vsed properly, othertimes applyed abusiuely.

THE EIGHT CHAPTER.

Containing proofes out of our manner of proceeding to action, that our soule is incorporeall.

1. That the soules being a power to order thinges proueth her to be immateriall.

I Doubt not but what we haue already said, hath sufficiently conuinced our soules being immateriall, vnto whomsoeuer is able to penetrate the force of the arguments we haue brought for proofe thereof, and will take the paines to consider them duely: (which must be done, by serious and continued reflection, and not by cursary reading, or by interrupted attempts) yet since we haue still a whole field of proofes vntouched, and that in so important a matter, no euidence can be too cleare, nor any paines

paines be accounted loſt, that may redouble the light, although it shine already bright enough to diſcerne what we ſecke; we will make vp the concert of vnanimous teſtimonies to this already eſtablished truth, by adding thoſe arguments we shall collect out of the manner of our ſoules proceeding to action, vnto the others we haue drawne from our obſeruations vpon her apprehenſions, her iudgements, and her diſcourſes.

Looking then into this matter: the firſt conſideration we meete withall is, that our vnderſtanding is in his owne nature an *orderer*; and that his proper worke is to ranke and putt thinges in order: for if we reflect vpon the workes and artes of men, as, a good life, a common-wealth, an army, a houſe, a garden, all artefactes; what are they, but compoſitions of well ordered partes? And in euery kind, we ſee that he is the Maſter, and the Architect, and is accoũted the wiſeſt, and to haue the beſt vnderſtanding, who can beſt, or moſt, or further then his fellowes, ſett things in order. If then to this we ioyne, that quantity is a thing whoſe nature conſiſteth in a capacity of hauing partes and multitude, and conſequently is the ſubiect of ordering and ranking; doth it not euidently follow, that our ſoule, compared to the whole maſſe of bodies, and to the very nature of corporeity or quantity, is as a proper agent to its proper matter to worke vpon? Which if it be, it muſt neceſſarily be of a nobler ſtraine, and of a different and higher nature then it; and conſequently, can not be a body, or be compoſed of Quantity: for had matter in it ſelfe, what it expecteth and requireth from the agent, it would not neede the agents helpe, but of it ſelfe it were fitt to be an Agent. Wherefore if the nature of corporeity, or of body, in its full latitude, be *to be ordered*, it followeth that the thing whoſe nature is to be an *orderer*, muſt as it is ſuch, be not a body, but of a ſuperiour nature, and exceeding a Body: which we expreſſe by calling it a ſpirituall thing.

2. That the ſoules being able to moue without being mooued, doth proue her to be immateriall.

Well then, if the ſoule be *an orderer*, two thinges belong neceſſarily vnto her: the one is, that she haue this order within her ſelfe, the other is, that she haue power to communicate it vnto ſuch thinges, as are to be ordered. The firſt she hath by ſcience, of which enough already hath beene ſaid towardes prooving our intent. Next, that her nature is communicatiue of this order, is euident out of her action and manner of working. But whether of her ſelfe she be thus communicatiue, or be ſo by her coniunction to the body she informeth, appeareth not from thence. But where experiẽce falleth short, reaſon ſupplyeth, and sheweth vs that of her owne nature she is communicatiue of order; for ſeeing that her action is an *ordering*, and that in this line there are but two ſortes of thinges in the world, namely, ſuch as do order, and ſuch as are to be ordered; it is manifeſt, that the action muſt by nature and in the vniuerſall conſideration of it, beginne from the *orderer* (in whom order hath its life and ſubſiſtence) and not from that which is to receiue it: then,

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ſithence *ordering* is motion, it followeth euidently, that the ſoule is a mooner and a beginner of motion.

But ſince we may conceiue two ſortes of mooners; the one when the agent is mooued to mooue; the other, when of it ſelfe it beginneth the motion without being mooued; we are to enquire, vnto which of theſe two the ſoule belongeth But to apprehend the queſtion rightly, we will illuſtrate it by an example: lett vs ſuppoſe that ſome action is fitt to beginne at tenne of the clocke: now we may imagine an agent to beginne this action in two different manners; the one, that the clocke ſtriking tenne, breedeth or ſtirreth ſomewhat in him, from whence this action followeth: the other manner is, that the agent may of his owne nature, haue ſuch an actuall comprehenſion or decurrence of time within himſelfe, as that without receiuing any warning from abroad, but as though he moued and ordered the clocke as well as his owne inſtruments, he may of himſelfe be fitt and ready, iuſt at that houre to beginne that action; not as if the clocke told him what houre it is, but as if he by gouerning the clocke, made that houre to be, as well as he cauſeth the action to beginne at that houre. In the firſt of theſe manners, the agent is mooued to mooue: but in the ſecond, he mooueth of himſelfe, without being mooued by any thing elſe. And in this ſecond way, our ſoule of her owne nature communicateth her ſelfe to quantitatiue thinges, and giueth them motion: which followeth out of what we haue already prooued; that a ſoule, in her owne nature, is the ſubiect of an infinite knowledge, and therefore is capable of hauing ſuch a generall comprehenſion, as well of time, and of the courſe of all other thinges, as of the particular action ſhe is to doe; and conſequently, ſtandeth not in neede of a Monitor without her, to direct her when to beginne.

If then it be an impreuaricable law with all bodies, that none whatſoeuer can mooue vnleſſe it be mooued by an other; it followeth, that the ſoule which mooueth, without being ſtirred or excitated by any thing elſe, is of a high race then they; and conſequently is immateriall and voyde of Quantity. But lett me not be miſtaken in what I come from ſaying; as though my meaning were, that the ſoule exerciſeth this way of mouing her ſelfe, and of ordering her actions while ſhe is in the body: for how can ſhe; ſeeing ſhe is neuer endowed with complete knowledge requiſite for any action, neuer fully comprehending all the circumſtances of it? But what I intend, is that the nature of the ſoule, conſidered in it ſelfe, is ſuch, as hath a capacity and may reach to this manner of working, (whence I inferre that ſhe is not a body but a ſpirit) without determining, whether ſhe worke thus in the body, or out of it: that enquiry belongeth not to this place; it will follow by and by.

3. That the ſoules proceeding to action with an vniuerſality, and indifferency doth prooue the ſame.

But for the preſent, hauing conſidered vnto what kind of working, the nature of the ſoule in abſtract, is capable of attaining; we will conclude this Chapter with reflecting vpon thoſe actions of hers, which fall dayly vnder our remarke, as being exerciſed in the body. In all of them

them we may obſerue, that she proceedeth with a certaine vniuerſality and indifferency, beyond the practiſe of all other creatures whatſoeuer: for example, if a man be ſpoken to, or asked of a hundred ſeuerall thinges that he neuer thought of before in all his life, he will immediately shape pertinent replyes, to all that is ſaid, and returne fitting anſweres to euery queſtion: as, *Whither ſuch a man goeth? How long this ſtaffe is? What colour that mans clothes are of? &c.*: to all which, and to as many thinges more as you will (ſo they be within the compaſſe of his knowledge) he ſtraight anſwereth differently, and to the purpoſe. Whence it is manifeſt, that his anſweres do not proceed vpon ſett gimals or ſtringes, whereof one being ſtrucke, it moueth the reſt in a ſett order, (which we haue shewed, is the courſe in all actions done by beaſtes) but out of a principle within him, which of it ſelfe is indifferent to all thinges; and therefore can readily apply it ſelfe to the anſwere, according as by the queſtion it is moued: and the like may be obſerued in his actions; which he varyeth according to the occaſions preſented.

I remember how Sir Philip Sidney (the Phœnix of the age he liued in, and the glory of our nation, and the patterne to poſterity of a complete, a gallant, and a perfect gentleman) aptly calleth our handes, the inſtruments of inſtruments; from Ariſtotle, who termeth them *Organa organorum*, or vniuerſall inſtruments, fitly moulded to be employed in any ſeruice; whereas nature hath to all other creatures appropriated their inſtruments to determinate actions, but to man, she hath (in theſe) giuen ſuch, as might be applyed to any kind of worke whatſoeuer: and accordingly we ſee, that the ſame kind of bird, ſtill buildeth her neaſt and breedeth her young ones, in the ſame way, without any the leaſt variance at all: but men do build their houſes as they pleaſe, ſometimes vpon hils, ſometimes in vales, ſometimes vnder the earth, and ſometimes vpon the toppes of trees: and the manners of breeding or inſtructing their children, are as diuers, as the cuſtomes of nations and townes: and in all other actions, our Maſters note it for a property peculiar to man, that he vſeth to arriue vnto the ſame end by diuers meanes; as to tranſport ourſelues to ſome place we would goe vnto, eyther by water, or by horſe, or by coach, or by litter, as we pleaſe: whereas we ſee no ſuch variety in like actions of other liuing creatures.

All which being ſo, we may conclude, that the ſoules proceeding eyther to anſweres, or to action, argueth cleerely that she hath within her ſelfe ſuch an indifferency, as is ioyned with a meanes to determine this indifferency: the contrary whereof we ſee in all corporeall engines; for they haue euery ſteppe in the whole courſe of their wayes, chalked out vnto them, by their very framing, (as hath beene amply declared in the firſt Treatiſe) and haue the determination of their worke, from end to end ſett downe, and giuen them by their artificier and maker: and therefore it is moſt euident, that the ſoule can not be a thing compoſed or framed of materiall and quantitatiue partes, ſeeing she hath not her

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wayes sett downe vnto her, but frameth them of her selfe, according to the accidents that occurre.

4. That the quiet proceeding of reason doth proove the same.

The same nature of the soule, discouereth it selfe in the quiet proceeding of *Reason*, when it worketh with greatest strength and vigour; as well knowing, that its efficaciousnesse consisteth not in the multitude of partes, which *Passion* breedeth, but in the well ordering of those it already hath vnder its command. Whereas the strength of Quantity, and the encrease of its strength, consisteth in the multitude of its partes: as will euidently appeare to whom shall consider this point deepely.

5. A conclusion of what hath beene said hetherto in this second Treatise.

Thus we haue in a summary manner gone through all the operations of the soule, which in the beginning of this latter Treatise, we heaped together as materials, wherewith to rayse an immateriall and spirituall building. Neyther, I hope, will our Reader be offended with vs, for being more succinct and concise in all our discourse concerning our soule, then where we deliuered the doctrine of Bodies: for the difficultnesse of this subiect, and the nicety required to the expressing our conceptions concerning it, wherein (as the Prouerbe is) a haire is to be clouen, would not allow vs that liberty of ranging about, as when we treated of Bodies. What occurreth among them, may be illustrated by examples within their owne orbe, and of their owne pitch; but to desplay the operations of a soule, we can find no instances that are able to reach them; they would rather embroile and darken them: for the exact propriety of wordes, must be strictly and rigorously obserued in them: and the Reader shall penetrate more into the nature and depth of them, by serious meditation and reflection vpon the hintes we haue here giuen, (efficacious enough, I hope, to excite those thoughts he should haue for this purpose, and to steere them the right way) then by much and voluminous reading, or by hearing long and polished discourses of this subiect.

For my part, if what I haue here said, should to any man appeare not sufficient to conuince that our soule is of a spirituall and farre different nature, from all such thinges as in our first Treatise we haue discoursed vpō, and taken for the heades and most generall kindes of Bodies, (vnto which all other particular ones, and their motions may be reduced) I shall become a suitor to him, in entreating him to take this subiect into his handling, where it beginneth to be vnwieldy for mine, and to declare vnto vs, vpon the principles we haue settled in the first Treatise, and vpon considering the nature of a body (which is the first of all our notions) how these particulars we haue reflected vpon in mans actions, can be drawne out of them; for I can find no possible meanes to linke them together: a vast and impenetrable Ocean, lyeth betweene the discoueries we haue made on each side of its shores; which forbiddeth all commerce between them; at the least, on the darke bodies side, which hath not winges to soare into the region of *Intellectuall* light. By those principles, we haue traced out the course and progresse of all operations belonging

belonging to ſenſe; and how beaſtes do or may performe all their actions, euen to their moſt refined and ſubtileſt operations: but beyond thē, we haue not beene able to carry theſe groundes, nor they vs. Lett him then take the paines to shew vs, by what figures, by what firſt qualities, by what mixtion of rare and denſe partes, an vniuerſall apprehenſion, an euident iudgement, a legitimate conſequence is made: and ſo of the like; as, of a mans determination of himſelfe to anſwere pertinently any queſtion; of his chooſing this way before that; &c. Which if he can doe (as I am ſure he can not) I shall allow it to be reaſō, and not obſtinacy, that worketh in his mind, and carryeth him againſt our doctrine: but if he can not, and that there is no apparence nor poſſibility (as indeede there is not) that theſe actions can be effected by the ordering of materiall partes, and yet he will be ſtill vnſatisfyed, without being able to tell why, (for he will be vnwilling to acknowledge, that theſe abſtracted ſpeculations, do not ſinke into him, and that nothing can conuince him, but what his ſenſes may be iudges of, and that he may handle, and turne on euery ſide like a bricke or a tile) and will be ſtill importune with cauillous ſcrupules, and wilde doubts, that in truth, and at the bottome do ſignifyy nothing, we will leaue him to meditate at his leiſure vpon what we haue ſaid; whiles we proceed on to what followeth out of this great principle, *That our ſoule is incorporeall and ſpirituall.*

THE NINTH CHAPTER.

That our ſoule is a Subſtance, *and* Immortall.

HAuing concluded that our ſoule is immateriall and indiuiſible; to proceed one ſteppe further, it can not be denyed, but that it is eyther a ſubſtance or an accident; if the later, it muſt be of the nature of the ſubſtance whoſe accident it is: for ſo we ſee all accidents are: but in man when his ſoule is excluded, there is no ſpirituall ſubſtance at all, whereof we haue any notice: and therefore if it be an accident, it muſt be a corporeall accident, or ſome accident of a body; as ſome figure, temperature, harmony, or the like: and conſequently, it muſt be diuiſible: but this is contrary to what is proued in the former Chapters: and therefore it can not be a corporeall accident. Neyther can it be a ſpirituall accident: for vnto what ſpirituall ſubſtance should it belong, when as nothing in man can be ſuſpected to be ſpirituall, but it ſelfe. Seeing then that it can be no accident, a ſubſtance it muſt be, and muſt haue its *Exiſtence* or *Being* in it ſelfe.

1. That Mans Soule is a ſubſtance.

Here we haue paſſed the Rubicon of experimentall knowledge: we are now out of the boundes that experience hath any iuriſdiction ouer: and from henceforth, we muſt in all our ſearches and concluſions rely

2. That man is compounded of ſome other ſubſtance beſides his body.

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only vpon the ſingle euidence of Reaſon. And euen this laſt concluſion we haue beene faine to deduce out of the force of abſtracted reaſoning vpon what we had gathered before; not by immediate reflection vpon ſome action we obſerue proceeding from a man: yet withall, nature flasheth out by a direct beame, ſome litle glimmering of the verity of it, to the eye of Reaſon that is within vs: for as whē we ſee a clocke mooue, or a mill, or any thing that goeth by many wheeles, if we marke that there are two contrary motions, in two diuers partes of it, we can not think that thoſe contrary motions, do belong to one and the ſame continued body, but ſhall preſently conclude, that there muſt be in that engine two ſeuerall bodies compacted together; ſo in man, though his body be the firſt moouer that appeareth vnto vs, yet ſeeing that in his actions, ſome effects do shew themſelues, which it is impoſſible should proceed from a body, it is euident, that in him there is ſome other thing beſides that one which we ſee: and conſequently we may conclude, that he is compoſed of a body and of ſomewhat elſe that is not a body: which *ſomewhat elſe*, being the ſpring from whence thoſe actions flow, that are of a different ſtraine from them that are deriued from the body, muſt neceſſarily be a ſpirituall ſubſtance.

3. That the ſoule doth ſubſiſt of it ſelfe independently of the body.

But whiles we are examining, how farre our preſent conſiderations, and short diſcourſes may carry vs, as it were experimentally to confirme this truth, we muſt not omitt what Auicenna in his booke *de Anima & Almahad*, and Monſieur des Cartes in his Methode, do preſſe vpon the ſame occaſion. Thus they ſay, or to like purpoſe: if I caſt with my ſelfe, who I am that walke, or ſpeake, or think; or order any thing; my reaſon will anſwere me, that although my legges or tōgue were gone, and that I could no longer walke or ſpeake, yet were not *I* gone, and I should know and ſee with my vnderſtanding, that I were ſtill the very ſame thing, the ſame *Ego* as before. The ſame as of my tongue or legges, would reaſon tell me of my eyes, my eares, my ſmelling, taſting, and feeling, eyther all of them together, or euery one of them ſingle, that were they all gone, ſtill should *I* remaine: As when in a dreame, (where I vſe none of all theſe) I both am, and know my ſelfe to be. Reaſon will tell me alſo, that although I were not nourished, ſo I were not waſted, (which for the drift of the argument may be ſuppoſed) yet ſtill I should continue in *Being*. Whence it would appeare, that my hart, liuer, lnges, kidneyes, ſtomacke, mouth, and what other partes of me ſoeuer, that ſerue for the nourishment of my body, might be ſeuered from me, and yet I remaine what I am. Nay, if all the beautifull and ayry fantaſmes, which fly about ſo nimbly in our braine, be nothing elſe but ſignes vnto in our ſoule, of what is without vs; it is euident, that though peraduenture she would not without their ſeruice, exerciſe that which by errour we miſſename *Thinking*; yet the very ſame ſoule and thinker might be without them all: and conſequently, without braine alſo; ſeeing that our braine is but the play-houſe and ſcene, where all theſe faery maskes are acted: ſo that in concluſion Reaſon

ſion Reaſon aſſureth vs, that when all body is abſtracted in vs, there ſtill remaineth a *ſubſtãce*, a *thinker*, an *Ego*, or *I*, that in it ſelfe is no whitt diminished, by being (as I may ſay) ſtripped out of the caſe it was encloſed in.

And now I hope the intelligẽt Reader will conceiue I haue performed my promiſe, and haue shewed the ſoule of man to be an *Immortall ſubſtance*: for ſince it is a *ſubſtance*, it hath a *Being*; and ſince it is an immateriall ſubſtance, it hath a *Being* of its owne force; without needing a conſort body, to helpe it to ſuſtaine its *Exiſtence*: for to be a ſubſtance, is to be the ſubiect of *Exiſtence*; and conſequently, to be an immateriall ſubſtance, is to be a ſubiect capable of *Exiſtence*, without the helpe of matter or of Quantity. It can not therefore be required of me, to vſe any further induſtry, to proue ſuch a ſoule to be immortall: but who will contradict her being ſo, is obliged to shew that she is mortall: for it followeth in reaſon, that she will keepe her *being*, vnleſſe by ſome force she be bereaued of it; it being a rule, that whoſoeuer putteth a thing to be, is not bound, for the continuation of that thinges being, to proue that it is not changed: but on the other ſide, he that auerreth it is changed, is bound to bring in his euidence of a ſufficient cauſe to change it: for to haue a thing remaine, is natures owne dictamen, and followeth out of the cauſes which gaue it *being*: but to make an alteration, ſuppoſeth a change in the cauſes; and therefore the obligation of proofe lyeth on that ſide.

4. Two other arguments to proue the ſame: one poſitiue, the other negatiue.

Neuertheleſſe, to giue ſatisfaction to thoſe, who are earneſt to ſee euery article poſitiuely prooued, we will make that part too our *Prouince*. Lett vs then remember, that *Immortality* ſignifyeth a negation, or a not hauing of *Mortality*: and that a poſitiue terme, is required to expreſſe a change by; ſince nature teacheth vs, that what ſoeuer is, will remaine with the *Being* it hath, vnleſſe it be forced out of it: if then we shew, that Mans ſoule hath not thoſe groundes in her, which maketh all thinges we ſee, to be mortall; we muſt be allowed to haue acquitted ourſelues of the charge, of prouing her *Immortall*. For this end, lett vs looke round about vs, and enquire of all the thinges we meete with, by what meanes they are changed, and come to a periode, and are no more. The pure elements will tell you, that they haue their change, by rarefaction and condenſation, and no otherwiſe: mixed bodies, by alteration of their mixture: ſmall bodies, by the actiuity of the Elements working vpon them; and by the meanes of rarefaction and condenſation, entering into their very conſtitution, and breeding an other temperament, by ſeperation of ſome of their partes, and in their ſteade mingling others. Plantes, and trees, and other liuing creatures will tell you, that their nourishment, being inſinuated through their whole bodies, by ſubtile pores, and blinde paſſages, if they either be ſtopped by any accident, or elſe be filled with bad nourishment, the mixture of the whole faileth of it ſelfe, and they come to dye. Thoſe thinges which are violently deſtroyed, we ſee are made away, for the moſt part by diuiſion; ſo fire by

5. The ſame is prooued becauſe the ſoule can not be obnoxious to the cauſe of mortality.

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diuiſion deſtroyeth all that cometh in its way; ſo liuing creatures are deſtroyed, by their parting of their bloud from their flesh, or of one member from an other, or by the euaporation or extinction of their naturall heate. In fine, we are ſure that all thinges, which within our knowledge looſe the ir *Being*, do ſo by reaſon of their Quantity; which by diuiſion, or by rarefaction, and compreſſion, gaineth ſome new temperature, that doth not conſiſt with their former temper. After theſe premiſſes, I needе ſay no more: the concluſion diſplayeth it ſelfe readily and plainely, without any further trouble; for if our labour hath beene hitherto, to shew that our ſoule is indiuiſible, and that her operations are ſuch as admitt not quantitatiue partes in her; it is cleare, that she can not be mortall, by any of thoſe wayes, whereby we ſee thinges round about vs to perish.

The like argument we may frame out of locall motion; for ſeeing that all the alteratiue actions we are acquainted withall, be performed by locall motion, (as is deliuered, both in groſſe, and by detaile, in our firſt Treatiſe) and that Ariſtotle, and all vnderſtanding Philoſophers do agree, there can be no locall motion in an indiuiſible thing, (the reaſon whereof is euident, to whomſoeuer reflecteth vpon the nature of *Place*, and of *locall motion*) it is manifeſt, that there can be no motion to hurt the ſoule, ſince she is concluded to be *indiuiſible*.

6. The ſame is prooued becauſe the ſoule hath no contrary.

The common argument likewiſe vſed in this matter, amounteth to the ſame effect: to witt, that ſince thinges are deſtroyed only by their contraries; that thing which hath no contrary, is not ſubiect to deſtruction: (which Principle both Reaſon and experience, do euery where confirme:) but a humane ſoule is not ſubiect to contrariety: and therefore ſuch an one can not be deſtroyed. The truth of the aſſumption, may be knowne two wayes: firſt, becauſe all the contrarieties that are found within our cogniſance, do ariſe out of the primary oppoſition of *Rarity* and *Denſity*; from which the ſoule being abſolutely free, she likewiſe is ſo, from all that groweth out of that roote: and ſecondly, we may be ſure that our ſoule can receiue no harme from contrariety; ſince all contraries are ſo farre from hurting her, as contrarywiſe, the one helpeth her in the contemplation of the other: and as for contradiction in thoughts, which att different times our ſoule is capable of admitting, experience teacheth vs, that ſuch thoughts do change in her, without any preiudice to her ſubſtance; they being accidents, and hauing their contrariety only betwixt themſelues within her, but no oppoſition at all to her; which only is the contrariety that may haue power to harme her: and therefore, whether ſoeuer of ſuch contrary thoughts be in the ſoule, pertaineth no more to her ſubſiſtence, then it doth to the ſubſiſtence of a body, whether it be here or there, on the right hand, or on the left.

7. The ſame is prooued from the end for which the ſoule was created.

And thus I conceiue my taske is performed; and that I am diſcharged of my vndertaking to shew the ſoules *Immortality*, which importeth no more

more, then to shew, that the causes of other thinges mortality, do not reach her. Yet being well persuaded, that my reader will not be offended with the addition of any new light, in this darke subiect; I will striue to discouer (if it be possible) some positiue proofe, or guesse, out of the property and nature of the soule it selfe, why she must remaine, and enioy an other life after this. To this end, lett vs cast our eye backe, vpon what hath beene already said, concerning her nature. We found that *truth* is the naturall perfection of Mans soule; and that she can not be assured of truth naturally, otherwise then by euidence: and therefore it is manifest, that euidence of truth, is the full complete perfection, at which the soule doth ayme. We found also, that the soule is capable of an absolute infinity of truth or euidēce. To these two, we will adde only one thing more, which of it selfe is past question, and therefore needeth no proofe; and then we will deduce our conclusion: and this is, that in a man his soule is a farre nobler, and perfecter part of him, then his body: and therefore, by the rules of nature and of wisedome, his body was made for his soule, and not his soule finally for his body.

These groundes being thus layed, lett vs examine, whether our soule doth in this life arriue to the end she was ordained for, or no: and if she do not then it must follow of necessity, that our body was made but for a passage, by which our soule should be ferried ouer into that state, where she is to attaine vnto that end, for which her nature is framed and fitted: the great skill, and artifice of nature, shewing and assuring vs, that she neuer faileth of compassing her end, euen in her meanest workes: and therefore without doubt would not breake her course in her greatest: whereof *man* is absolutely the head and chiefe, among all those that we are acquainted with. Now, what the end is, vnto which our soule doth ayme, is euident; since the perfection of euery thing, is the *end* for which it is made: the perfection then, and *end* of the soule being *euidence*; and she being capable of infinite *euidence*; lett vs enquire, whether in this life she may compasse it or no. To determine this question, lett vs compare infinite *euidence*, to that *euidence*, which the greatest and most knowing man that euer liued, hath acquired by the worke of nature alone; or to that euidence, which by aime we may imagine is possible euer to happen vnto any one man to arriue vnto: and balancing them well together, lett vs iudge whether all that any man can know here, is not in respect of what a mans soule is capable of, to be stiled as nothing, and deserueth not the name of euidence, nor to be accounted of that nature: and if our sentence do conclude vpon this, lett vs acknowledge that our soule arriueth not to her perfection, nor enioyeth her end, in this world; and therefore, must haue infaillibly an other habitation in the next world, vnto which nature doth intend her. Experience teacheth vs, that we can not fully comprehend any one of natures workes: and those Philosophers, who in a disciplinable way search into nature, (and therefore are called Mathematicians) after they haue written large volumes of some very slender subiect, do euer find, that they haue left vntouched, an

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endleſſe abiſſe of knowledge, for whomſoeuer ſhall pleaſe to build vpon their foundations: and that they can neuer arriue neere ſaying all that may be ſaid of that ſubiect, though they haue ſaid neuer ſo much of it. We may not then make difficulty to beleeue, that the wiſeſt and learnedeſt men in the world, haue reaſon to profeſſe with the father of Philoſophers, that indeede they know nothing. And if ſo, how farre are they from that happineſſe and perfection, which conſiſteth in knowing all thinges? Of which full ſea, we neuertheleſſe find euen in this low ebbe, that our ſoule is a channell capable; and is framed a fitt veſſell and inſtrument to receiue it, when the tide ſhall come in vpon it: which we are ſure it can not do, vntill the bankes of our body which hinder it, be broken downe.

8. The ſame is prooued becauſe she can mooue without being mooued.

This laſt conſideration, without doubt, hath added no ſmall corroboration to our former proofes; which are ſo numerous and ſo cleare, as peraduenture it may appeare ſuperfluous, to ſay any more to this point: ſince one conuincing argument eſtabliſheth the verity of a concluſion, as efficaciouſly as a hundred: and therefore Mathematicians vſe but one ſingle proofe, in all their propoſitions; after which other ſupernumerary ones, would be but tedious Neuertheleſſe, ſince all the ſeuerall wayes, by which we may looke into the nature of our ſoule (the importanteſt ſubiect we can buſy our thoughts vpon) can not faile of being pleaſing and delightfull to vs, we muſt not omitt to reflect a litle vpon that great property of our ſoule, by which she is able to mooue and to worke, without her ſelfe being mooued or touched. Vnto which adding, that all life conſiſteth in motion, and that all motion of bodies cometh from ſome other thing without them; we may euidently conclude, that our ſoule, who can mooue without receiuing her motiō from abread, hath in her ſelfe a ſpring of life; for the which she is not beholding (as bodies are) to ſome extrinſecall cauſe, of a nature like vnto her; but only to him, who gaue her to *Be* what she is. But if she haue ſuch a ſpring of life within her, it were vnreaſonable to imagine, that she dyed vpon the occaſion of the death of an other thing, that exerciſeth no action of life, but as it is cauſed by an other.

9. The ſame is prooued from her manner of operation which is grounded in *being*.

Neyther may we neglect that ordinary conſideration, which taketh notice, that our ſoule maketh vſe of propoſitions of eternall truth; which we haue aboue produced, among our proofes for her being of a ſpirituall nature; and ſhall now employ it for the prouing her *Immortall*: by conſidering, that the notion of *Being*, which ſettleth theſe propoſitions ſo, as they feare no mutation or shaking by time, is the very roote of the ſoule; and that which giueth her her nature; and which sheweth it ſelfe in all her operations: ſo that, if from *Being*, arriueth vnto theſe propoſitions, to feare no time; the like muſt of neceſſity betide alſo the ſubſtāce of the ſoule. And thus we ſee, that her nature is out of the reach of time: that she can comprehend time, and ſett it limits: and that she can think of thinges beyond it, and caſt about for them. All which are cleare teſtimonies, that she is free and ſecure from the alldeuouring and

deſtroying

deſtroying tyranny of that Saturniall Conquerour of the whole world of matter and of Bodies, whoſe ſeruant is death.

10. Laſtly it is prooued from the ſcience of Morality, the principles whereof would be deſtroied if the ſoule were mortall.

After all theſe proofes drawne from the nature of the ſoule it ſelfe, euery one of them of force to conuince her immortality, I muſt craue leaue to adde one conſideration more, though it ſeemeth to belong vnto an others harueſt, namely to the ſcience of Morals: and it is, that the poſition of Mortality in the ſoule, taketh away all morality, and changeth men into beaſtes; by taking away the ground of all difference in thoſe thinges, which are to gouerne our actions. For ſuppoſing that the ſoule dyeth with the body; and ſeeing that man hath a comprehenſion or notion of time without end; it is euident, that the ſpanne of this life, muſt needes appeare contemptible vnto him, that well conſidereth and weigheth it againſt the other infinite duration: and by conſequence, all the goods, and euils which are partes of this life, muſt needes become as deſpicable and inconſiderable: ſo that better or worſe in this life, hath not any appearance of difference betweene them; at the leaſt, not enough to make him labour with paine to compaſſe the one, and eſchew the other, and for that end, to croſſe his preſent inclination in any thing, and engage himſelfe in any the leaſt difficult taske: and ſo it would enſue, that if to an vnderſtanding man, ſome courſe or action were propoſed vnto him, as better then that he were going about, or for the inſtant had a mind vnto, he would relish it, as a great marchant, or a Banquier would do, who dealing for Millions, one ſhould preſſe him with earneſtneſſe, to make him change his reſolued courſe, for the gaine of a farthing more this way then the other; which being inconſiderable, he would not trouble his head with it, nor ſtoppe at what he was in hand with. In like manner, whoſoeuer is perſuaded, that for an infinity of time he ſhall be *nothing*, and without ſenſe of all thinges, he ſcorneth for this litle twinckling of his life, to take any preſent paines, to be in the next moment well, or to auoyde being ill; ſince in this caſe, dying is a ſecure remedy to any preſent euill; and he is as ready to dye now, as a hundred yeares hēce; nor can he eſtime the loſſe of a hūdred yeares, to be a matter of moment: and therefore he will, without any further guidance or diſcourſe, betake himſelfe to do whatſoeuer his preſent inclination beareth him to with moſt facility; vpō this reſolutiō, that if any thing croſſe him, he will preſētly forgoe his life, as a trifle not worth the keeping: and thus, neyther vertue, nor honour, nor more pleaſure then what at the preſent tickleth him, doth fall into his account: which is the ouerthrow of the whole body of *Morality*, that is of mans action and nature. But all they who looke into ſciences, do croſſe that for an erroneous and abſurd poſition, which taketh away the Principles of any ſcience: and conſequently, the poſition of the ſoules *Mortality*, is to be eſteemed ſuch. There remaineth yet one conſideration more, and peraduenture more important, then any we haue yet mentioned, to conuince the ſoules immortality: which is, that ſpirituall thinges are in a ſtate of *Being*. But we

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shall not be able to declare this, vntill we haue proceeded a litle further.

THE TENTH CHAPTER.

Declaring what the ſoule of a man, ſeperated from his body, is: and of her knowledge and manner of working.

1. That the ſoule is one ſimple knowing act which is a pure ſubſtance and nothing but ſubſtance.

VNhappy man! how long wilt thou be inquiſitiue and curious to thine owne perill? Haſt thou not already payed too deare, for thy knowing more then thy share? Or haſt thou not heard, that who will prye into maieſty, shall be oppreſſed by the glory of it? Some are ſo curious (shall I ſay) or ſo ignorant, as to demaund, what a humane ſoule will be, after she is deliuered from her body: and vnleſſe they may ſee a picture of her, and haue whereby to fanſie her, they will not be perſuaded, but that all are dreames, which our former diſcourſes haue concluded: as if he, who findeth himſelfe dazeled with looking vpon the ſunne, had reaſon to complaine of that glorious body, and not of his owne weake eyes, that can not entertaine ſo reſplendent a light.

Wherefore to frame ſome conceit of a ſeperated ſoule, I will endeauour for their ſatisfaction, to ſay ſome what of her future ſtate. Lett vs then firſt conſider what a *Thought* is. (I do not meane, that corporeall ſpiritt, which beateth at our common ſenſe; but that which is within, in the inward ſoule, whoſe nature we find by diſcourſe and effects, though we can not ſee it in it ſelfe.) To this purpoſe we may obſerue, that if we are to diſcourſe, or to do any thing, we are guided the right way in that ſubiect we haue in hand, by a multitude of particular thoughts; which are all of them terminated in that diſcourſe or action: and conſequently, euery act of our mind, is as it were an actuall rule or direction, for ſome part of ſuch diſcourſe or action: ſo that we may conceiue a complete thought (compounded of many particular ones) to be a thing, that ordereth one entire diſcourſe or action of our life.

A thought being thus deſcribed, lett vs in the next place trye, if we can make an apprehenſion, what a *ſcience* or an *art* is: as, what the ſcience of *Aſtronomy* is; or what the art of playing on the *Organes* is, when the Aſtronomer thinketh not of the motions of the heauens, nor the Organiſt of playing on his inſtrument: which ſcience and art, do neuertheleſſe euen then reſide in the Aſtronomer, and in the Organiſt: and we find, that theſe are but the reſultes of many former complete thoughts; as being thoſe very thoughts in remainder; whatſoeuer this may ſignify.

Laſtly, lett vs conceiue (if we can) a *power* or *capacity* to *Being:* vnto which capacity, if any *Being* be brought, that it is vnſeperably glewed and

and riueted vnto it, by its very being a *Being*: and if any two thinges be brought vnto it, by the vertue of one *Being*, common to both those thinges, that both of them, by this one *being*, do become one betwixt themselues, and with this *capacity*; and that so there is no end or periode of this addition of thinges, by the mediation of *Being*; but that by linkes and ringes, all the thinges that are in the world, may hang together betwixt themselues, and to this *Power*; if all of them may be brought vnto it by the glew and vertue of *being*: in such sort as we haue formerly declared, passeth in the soule.

Now lett vs putt this together, and make vp such a thing, as groweth out of the capacity to *Being*, thus actuated and cleauing to all thinges that any way haue *being*; and we shall see, that it becometh a whole entire world, ordered and clinging together with as great strength and necessity, as can proceede from the nature of *Being*, and of *contradiction*: and our reason will tell vs, that such a thing, if it be actiue, can frame a world, such an one as we liue in, and are a small parcell of, if it haue matter to worke vpon; and can order whatsoeuer hath *Being*, any way that it is capable of being ordered, to do by it, and to make of it, whatsoeuer can be done by, and made of such matter.

All these conceptions (especially by the assistance of the last) may serue a litle to shadow out a perfect soule: which is, *a knowledge, an art, a rule, a direction, of all thinges*: and all this by being all thinges, in a degree and straine, proper and peculiar to it selfe: and an vnperfect soule, is a participation of this Idea: that is, a kn wledge, a rule, and a direction, for as much as it is, and as it attaineth vnto. Now as in our thoughts, it is the corporeall part only which maketh a noise, and a shew outwardly, but the spirituall thought, is no otherwise perceiued then in its effect, in ordering the bodily acts; in like sort, we must not conceiue this knowledge to be a *motion*; but meerely to be a *thing* or *Being*, out of which the ordering and mouing of other thinges doth flow; it selfe remaining fixed and immoueable: and becausc all that is ioyned vnto it, is there riueted by *Being*, or *identification*; and that when one thing is an other, the other is againe it; it is impossible that one should exceed the other, and be any thing that is not it: and therefore, in the soule there can be no partes, no accidents, no additions, no appendances, nothing that sticketh to it and is not it: but whatsoeuer is in her, is *soule*; and the soule, is all that which is within her; so that all that is of her, and all that belongeth vnto her, is nothing but one pure simple substance, peraduenture Metaphysically, or formally diuisible; (in such sort as we haue explicated in the first Treatise, of the diuisibility betweene quantity and substance) but not quantitatiuely, as bodies are diuisible. In fine, substance it is, and nothing but substance; all that is in it, being ioyned and imped into it, by the very nature of *Being*, which maketh substance. This then, is the substantiall conceite of a humane soule stripped of her body.

Now, to conceiue what proprieties this substance is furnished with;

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2. That a seperated soule is in no place, and yet is not absēt from any place.

lett vs reflect vpon the notions we frame of thinges, when we consider them in common: as when we think of a man, of bread, of some particular vertue, of a vice, or of whatsoeuer else; and lett vs note, how in such, our discourse determineth no *place*, nor *time*: nay, if it should, it would marre the discourse; as Logitians shew, when they teach vs, that scientificall syllogismes can not be made without vniuersall propositions: so that we see, vnlesse these thinges be stripped from *Place* and *Time*, they are not according to our meaning: and yet neuertheless, we giue them both the name, and the nature of a *Thing*, or of a *substance*, or of a *liuing Thing*, or of whatsoeuer else may by our manner of conceiuing or endeauours, be freed from the subiection of *time* and *Place*. Thus then we plainely see, that it is a very different thing, *to be*, and *to be in a Place*: and therefore, out of a *Thinges being in no Place*, it can not be inferred, *That it is not*; or *that it is no substance*: nor contrariwise, out *of its being*, can it be inferred, *that it is in a Place*: there is no man but of himselfe perceiueth the false consequence of this argument, a thing is, therefore it is hoat, or it is cold: and the reason is, because hoat and cold, are particular accidents of a body; and therefore a body can be without eyther of them. The like proportion is betweene *Being* in generall, and *Being a Body*, or *Being in a Body*: for both these, are particulars in respect of *Being*: but *to be in a Place*, is nothing else, but *to be in a circumstant Body*: and so, what is not in a Body, is not in a Place: therefore, as it were an absurd illation to say, *it is*, therefore *it is in a Body*; no lesse is it to say, *it is*, therefore *it is somewhere*; which is equiualent to, *in some Body*: and so a great Master (Peraduenture one of the greatest, and iudiciousest that euer haue beene) telleth vs plainely, that of *it selfe it is* euident, to those who are truly learned, that *incorporeall substances are not in* Place: and Aristotle teacheth vs, *that the Vniuerse is not in* Place.

Boetius.

But now to make vse of this discourse, we must intimate what it is we leuell at in it: we direct it to two endes; first, to lead on our thoughts, and to helpe our apprehension, in framing some conception of a spirituall substance, without residence in Place; and to preuēt our fansies checking at such abstraction; since we see that we vse it in our ordinary speech, when we thinke not on it, nor labour for it, in all vniuersall and indefinite termes: next, to trace out an eminent propriety of a seperated soule: namely, that she is no where; and yet (vpon the matter) that she is euery where: that she is bound to no Place, and yet remote from none: that she is able to worke vpon all, without shifting from one to an other, or coming neere any: and that she is free from all, without remoouing or parting from any one.

3. That a seperated soule is not in time nor subiect to it.

A second propriety, not much vnlike this first, we shall discouer in a seperated soule, if we compare her with *time*. We haue heretofore explicated, how *Time* is the motion of the heauens; which giueth vs our motion; which measureth all particular motions; and which comprehendeth all bodies, and maketh them awayte his leisure. From the large

empire

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empire of this proud commander, a ſeparated ſoule is free: for although she do conſiſt with time, (that is to ſay, she is, whiles time is;) yet is she not in time; nor doth she in any of her actions, expect time; but she is able to frame time, to ſpinne or weaue it out of her ſelfe, and to maſter it.

All which will appeare manifeſtly, if we conſider what it is *to be in time*. Ariſtotle sheweth vs; that, *to be comprehended vnder time*, or *to be in time*, is, to be one of thoſe mooueables, whoſe *being* conſiſting in motion, taketh vp but a part of *Time*; and hath its termes, before, and behind, in *time*; and is meaſured by *Time*; and muſt expect the flowing of *Time*, both for *Being*, and for *Action*. Now all this manifeſtly belongeth vnto Bodies, whoſe both *action* and *being*, is ſubiect to a perpetuall locall motion and alteration: and conſequently, a ſeparated ſoule, who is totally a *Being*, and hath her whole operation all together (as being nothing but her ſelfe when we ſpeake of her perfectiue operation;) can not be ſaid to be in time, but is abſolutely free from it; though time do glide by her, as it doth by other thinges: and ſo, all that she knoweth or can do, she doeth and knoweth at once, with one act of the vnderſtanding or rather, *she* is, (indeede and really) *all that*: and therefore, she doth not require time to manage or order her thoughts, nor do they ſucceed one an other, by ſuch viciſſitudes as men are forced to thinke of thinges by, becauſe their fanſie, and the images in it which beate vpon the ſoule to make her thinke, whiles she is in the body, are corporeall, and therefore, do require time to mooue in, and to giue way to one and other: but she thinketh of all the thinges in the world, and of all that she can thinke of, together and at once; as hereafter we intend to shew.

4. That the ſoule is an actiue ſubſtance, and all in it is actiuitie.

A third propriety we may conceiue to be in a ſeparated ſoule, by apprehending her to be *an Actiuity*; which that we may rightly vnderſtand, lett vs compare her, in regard of working, with a body: reflecting then vpon the nature of bodies, we shall find, that not any of them will do the functions they are framed for, vnleſſe ſome other thing do ſtirre them vp, and cauſe them ſo to do. As for example; a knife, if it be thruſt or preſſed, will cutt, otherwiſe, it will lye ſtill and haue no effect: and as it fareth with a knife, ſo it doth in the ſame manner with thoſe bodies, which ſeeme moſt to mooue themſelues; as vpon a litle conſideration, will appeare plainely. A beaſt ſeemeth to mooue it ſelfe: but if we call to minde, what we haue deliuered vpon this ſubiect in the firſt Treatiſe, we shall find that whenſoeuer he beginneth to mooue, he eyther perceiueth ſomething by his ſenſe, which cauſeth his motion, or elſe he remembreth ſomething that is in his braine, which worketh the like effect. Now if ſenſe preſenteth him an obiect that cauſeth his motion, we ſee manifeſtly, that it is an externall cauſe which maketh him mooue: but if memory do it, we shall find that ſtirred by ſome other part; as by the ſtomacke, or by the heart, which is empty, or heated, or hath receiued ſome other impreſſion from an other body, ſo that, ſooner or later, we shall diſcouer an outward moouer. The

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like is in naturall motions;as, in heauy thinges, their easy following (if they be sucked) an other way then downewardes, testifyeth that their motion downewardes hath an extrinsecall motor, as is before declared: and not only in these,but throughout,in all other corporeall thinges.So that in a word,all bodies are of this nature,that vnlesse some other thing presse them and alter them,when they are quiett, they remaine so; and haue no actiuity,otherwise then from an extrinsecall moouer: but of the soule,we haue declared the contrary;and that,by its nature,motion may proceed from it,without any mutation in it,or without its receiuing any order,direction,or impulse,from an extrinsecall cause.

5. A description of the soule.

So that, now summing vp together, all we haue said vpon this occasion,we find a soule exempted from the body, to be; *An indiuisible substance, exempted from place and time, yet present to both: an actuall and present knowledge of all thinges that may be knowne: and a skill or rule, euen by what it selfe is, to all thinges whatsoeuer.* This she is, if she be perfect: but if she be imperfect; then, is she all this to the proportion of her groweth,(if so I may say) and she is powerfull according to the measure of her knowledge, and of her will.So that in fine,a seperated soule,is of a nature to haue,and to know,and to gouerne all thinges.

6. That a seperated soule knoweth all that which she knew whilst she was in her bodie.

I may reasonably suspect, that my saying how imperfect soules are rules *to the proportion of their groweth*, may haue occasioned great reflexion,and may haue bredd some trouble in the curious and heedefull reader. I confesse this expression was deliuered by me, only to free my selfe for the present from the labour of shewing what knowledge euery seperated soule hath:but vpon second thoughts,I find that such sliding ouer this difficult point will not serue my turne,nor saue me the paines of vntying this knott:for vnlesse I explicate what I meane by that speech, I shall leaue my Reader in great doubt and anxiety; which to free him from,I must wade a litle further in this question *of the extent of a seperated soules knowledge*, into which, I haue thus, vpon the by, engaged my selfe:but lett him first be aduertised,that I do not here meddle, with what a seperated soule may know by reuelation, or by supernaturall meanes:but that I do only tracke out her naturall pathes; and do guesse at what she is,or knoweth,by that light which her conuersation in her body affordeth vs.

Our entrance into this matter must be,to consider what mutation in respect of knowledge,a soules first change out of her body, maketh in her;for it is not vnlikely,but that nature may some way enlighten vs so farre,as to lett vs vnderstand what must follow out of the negation of the bodies consorteshippe,added vnto what we know of her and other workes in this world.This then first occurreth that surely she can not choose but still know in that state,all that she did know whiles she was in the body;since we are certaine that the body hath no part in that which is true knowledge:as is aboue declared, when we shewed; first, that all

true

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true knowledge is respectiue; secondly, that the first impressions of the fansie, do not reach to the interiour soule; and lastly, that she worketh by much more, then what hath any actuall correspondence in the fansie, and that all thinges are vnited to her by the force of *Being*: from which last, it followeth that all thinges she knoweth, are *her selfe*; and she, *is, all that she knoweth*: wherefore, if she keepeth *her selfe* and her owne *Being*, she must needes keepe the knowledge of all that she knew in this world.

Next, she must vndoubtedly know then somewhat more, then she knew in the body; for seeing that out of the thinges she already knoweth, others will follow by the meere ordering and connexion of them; and that the soules proper worke, *is to order thinges*: we can not doubt, but that, both the thinges she knoweth in this world, must of necessity be ordered in her to th best aduantage; and likewise, that all that, will be knowne, which wanteth no other cause for the knowing of it, but the ordering of these thinges: for if the nature of a thing, were *order*, who can doubt but what were putt into that thing, were putt into *order*? Now, that the nature of the soule is such, we collect easily; for seeing that all order proceedeth from her, it must be acknowledged that *order* is first in her: but what is in her, is her nature: her nature then, is *order*; and what is in her, is ordered. In saying of which, I do not meane that there is such an order betweene the notions of a seperated soule, as is betweene materiall thinges, that are ordered by the soule whiles she is in the body; for seeing that the soule is adæquate cause of such order; (that is to say, a cause which can make any an such, and the whole kind of it;) it followeth, that such order is not in her; for if it were, she would be cause of her selfe, or of her owne partes. Order therefore, in her, must signify a thing more eminēt, thē such inferiour order, in which resideth the power of making that inferiour *order*: and this is nothing else, but the cōnexion of her notions by the necessity of *Being*; which we haue oftē explicated. And out of this eminēt or superiour kind of order, our conclusion followeth no lesse then if the inferiour order which we see in our fansies, whiles our soule is in our *Body*, did reside in our interiour soule; for, it is the necessity of identification, which doth the effect, and maketh the soule know; and the order of fantasmes, is but a precedent condition in the bodily Agent, that it may worke vpon the soule; and if more fantasmes then one could be together, this order would not be necessary.

7. That the least knowledge which the soule acquireth in her bodie of anie one thing doth cause in her, when she is seperated from her bodie a compleat knowledge of all things whatsoeuer.

Out of this, a notable and a vast conclusion, manifestly followeth: to witt, that if a soule, can know any one thing more when she is out the body, then what she did know whiles she was in the body; without any manner of doubt, she knoweth all that can be drawne, and forced out of those knowledges, which she had in her body. How much this is, and how farre it will reach, I am affraide to speake: only I entreate Mathematicians, and such as are acquainted with the manner how sciences proceed; to consider how some of their definitions are made: to witt by

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compoſing together ſundry knowne termes, and giuing a new name to the compound that reſulteth out of them: wherefore cleare it is, that out of fewer notions had at the firſt, the ſoule can make many more: and the more she hath, or maketh, the more she can multiply. Againe, the maximes, which are neceſſary to be added vnto the definitions for gaining of knowledge, we ſee are alſo compounded of ordinary and knowne termes; ſo that a ſeperated ſoule, can want neyther the Definitions, nor the Maximes, out of which the bookes of ſciences are compoſed: and therefore, neyther can the ſciences themſelues be wanting vnto her. Now if we conſider, that in the ſame fashion as demonſtrations are made, and knowledge is acquired in one ſcience, by the ſame meanes, there is a tranſcendence from ſcience to ſcience: and that there is a connexion among all the ſciences, which fall into the conſideration of man, and indeede among all, at the leaſt corporeall thinges; (for of ſpirituall thinges, we can not ſo aſſuredly affirme it: although their perfection may perſuade vs, that there is rather a greater connexion among them, then among corporeall thinges) it will follow, that a ſoule which hath but any indifferent knowledge in this world, ſhall be replenished with all knowledge in the next.

But how much is this indifferent knowledge, that for this purpoſe is required in this world? Vpon mature conſideration of this point, it is true, I find it abſolutely neceſſary, that the ſoule muſt haue here ſo much knowledge, as to be able to determine that ſome one thing, which hath connexion with all the reſt, is in ſuch a time: but then, why out of this very conception, she should not be able to clymbe vp by degrees, to the knowledge of all other thinges whatſoeuer (ſince there is a connexion betweene that, and all the reſt, and no vntranſible gappe, or Chaos to ſeuer them) I profeſſe I do not ſee. Which if it be ſo, then the ſoule of an abortiue in his mothers wombe, if he once arriue to haue ſenſe, and from it, to receiue any impreſſion in his ſoule, may for ought I know, or can ſuſpect to the contrary, be endewed in the next world with as much knowledge, as the ſoule of the greateſt Clerke that euer liued: and if an abortiue do not arriue ſo farre, as to the knowledge of ſome one thing, I know no reaſon, why we should belieue it arriued to the nature of man.

Whence it followeth, that this amplitude of knowledge, is common to all humane ſoules, (of what pitch ſoeuer they ſeeme to bee here) when they are ſeperated from their bodies: as alſo, that if any errour haue crept into a mans iudgement, during this life, whether it be of ſome vniuerſall concluſion, or of ſome particular thing, all ſuch will be abolished then, by the truth appearing on the oppoſite ſide; ſi thence two contradictory iudgements, can not poſſeſſe our ſoule together: as euen in this world, as well experience, as reaſon teacheth vs.

But vnawares I haue engulfed my ſelfe into a ſea of contradiction, from no meane aduerſaries: for Alexander Aphrodiſeus, Pomponatius, and

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and the learnedeſt of the Peripatetike ſchoole, will all of them riſe vp in maine oppoſition againſt this doctrine of mine: ſhewing how in the body, all our ſoules knowledge is made, by the working of our fanſie; and that there is no act of our ſoule, without ſpeculation of fantaſmes reſiding in our memory: therefore, ſeeing that when our body is gone, all thoſe litle bodies of fantaſmes are gone with it; what ſigne is there, that any operation can remaine? And hence they inferre, that ſeeing euery ſubſtance hath its *Being* for its operations ſake, and by conſequence were vaine and ſuperfluous in the world, if it could not enioy and exerciſe its operation; there is no neceſſity or end, why the ſoule of a man ſhould ſuruiue his body: and conſequently, there is no reaſon to imagine other, then that it periſheth when the man dyeth. This is the ſubſtance of their argument; which indeede is nothing elſe, but to gueſſe without ground, or rather againſt all ground: but howſoeuer, this comfort I haue, that I haue to do with Peripatetikes; men that will heare and anſwere reaſon: and to ſuch I addreſſe my ſpeech.

8. An anſwere to the obiections of ſome Peripatetikes who maintaine the ſoule to perish with the body.

To ioyne iſſue then with them, and to encounter them with their owne weapons, lett vs call to minde, what Ariſtotle holdeth light to be. He ſaith, *that it is a ſuddaine and momentary emanation of what it is, following the precedent motion of ſome body, but without motion in it ſelfe*. As for example: when the ſunne cometh into our horizon, (ſaith he) the illumination of the horizon, is an effect in an inſtant, following from the motion which the ſunne had, ſince his ſetting in the other hemiſphere, vntill he appeare there againe: ſo that (according to him) the way of making this light, is the ſunnes locall motion; but the effect or *the being enlightened*, is a thing of a very different nature, done without beginning, and continuing vntill the ſunne departe againe from our horizon. And as he explicateth this action of illumination, in the ſame manner, doth he the actions of ſenſe and of vnderſtanding. Vpon all which I vrge, that no Peripatetike will deny me, but that as in euery particular ſenſation or thinking, there precedeth a corporeall motion, out of which it enſueth, ſo this generall motion, which we call *the life of Man*, precedeth that twinkle or moment, in which she becometh an abſolute ſpiritt, or inhabitant of the next world. Wherefore it can not be ſaid, that we introduce a doctrine aliene from the Peripatetike way of Philoſophiſing, if we putt a momentary effect or motion (according to their phraſe of ſpeaking) to follow out of the courſe of mans life; ſince they putt diuers ſuch effects, to follow out of particular partes of it.

Now, this momentary change, or what they pleaſe to call it, is that which maketh at one blow, all this knowledge we ſpeake of: for, if we remember that knowledge is not a *doing* or a *motion*, but a *Being*; as is agreed betweene the Peripatetikes and vs; they can not, for the continuing it, require inſtruments and motors: for they are neceſſary only for change, not for *Being*. Now, all this mighty change, which is made at the ſoules deliuery, we conceiue followeth preciſely out of the change of

her *Being*: for seeing it is supposed, that her *Being* was before in a body, but is now out of a body; it must of necessity follow, that all impediments, which grew out of her being in a body, must be taken away by her being freed from it. Among which impediments, one is, that time is then required betwixt her knowledge of one thing, and her knowledge of an other thing; and so her capacity, that of it selfe is infinite, becometh confined to that small multitude of obiects, which the diuision and straightnesse of time giueth way vnto. Now that, which length of time could in part worke in the body, the same is entirely done in a moment, by the changing of her manner of *Being*: for by taking away the bondes, by which she was enthralled in the body, and was kept in, to apprehend but according to the measure of the body, and was constrained to be, and to enioy her selfe (as it were) but at the bodies permission; she is putt in free possession of her selfe, and of all that is in her. And this is nothing else, but to haue that large knowledge, we haue spoken of; for her knowing all that, is no other thing but her being her selfe perfectly. Which will appeare euident, if we consider that her nature is, *to be a Knower*, and that knowledge is nothing else but a *Being of the obiect in the Knower*; for thence it followeth, that to know all thinges is naught else then to be all thinges: since then, we concluded by our former discourse, that all thinges were to be gathered out of any one; it is cleare that to be perfectly her selfe, and any one thing, is in truth to know all thinges.

And thus we see, that for the soules enioying all this knowledge when she is out of the body, she needeth no obiects without her, no phantasmes, no instruments, no helpes; but that all that is requisite, is cõtained absolutely in her being her selfe perfectly. And so we retort our Aduersaries obiection on themselues; by representing to them, that since in their owne doctrine, they require no body nor instruments, for that precise action which they call vnderstanding: it is without all ground, for them to require bodies and instruments in the next life, that the soule may there be that, which, they acnowledge she is in her body without any such helpes.

And as for that *axiome* or experience, *that the soule doth not vnderstand, vnlesse she speculate phantasmes*: as on the one side I yield to it, and confesse the experience, after the best and seriousest tryall I could make of it; so on the other side, when I examine the matter to the bottome, I find that it cometh not home to our aduersaries intention. For as when we looke vpon a thing, we conceiue we worke vpon that thing, whereas in truth we do but sett our selues in such a position that the thing seene may worke vpon vs: in like manner our looking vpon the phantasmes in our braine, is not our soules action vpon them, but it is our letting them beate at our common sense; that is, our letting them worke vpon our soule. The effect whereof is, that eyther our soule is bettered in her selfe, as when we study and contemplate: or else, that she

bettered

bettereth ſomething without vs, as when by this thinking, we order any action.

But, if they will haue this *Axiome* auayle them, they should shew that the ſoule is not of her ſelfe a knowledge; which if they be able to do, euen then when to our thinking, she ſeemeth not ſo much as to thinke, we will yield they haue reaſon: but that will be impoſſible to them to do; for she is alwayes, of her ſelfe, a knowledge, though in the body she neuer expreſſeth ſo much, but when she is putt to it. Or elſe they should shew, that this knowledge which the ſoule is of her ſelfe, will not by changing the manner of her *Exiſtence*, become an actuall knowledge, inſteed of the habituall knowledge which now appeareth in her.

9. The former Peripatetickes refuted out of Ariſtotle.

But as theſe Ariſtotelians embrace and ſticke to one *Axiome* of their Patrone; ſo they forgoe and preuaricate againſt an other: for as it is Ariſtotles doctrine, that a ſubſtance is for its operation, and were in vaine and ſuperfluous if it could not practiſe it; ſo likewiſe is it his confeſſed doctrine, that *Matter* is for its *forme*, and not the *forme*, for the *matter*. And yet theſe men pretend that the ſoule, ſerueth for nothing but the gouerning of the body: whereas contrawiſe, both all Ariſtotles doctrine, and common ſenſe conuinceth, that the body muſt be for the ſoule. Which if it be, nothing can be more conſentaneous to Reaſon, then to conceiue that the durance which the ſoule hath in the body, is aſſigned her, to worke and moulde in her the future ſtate, which she is to haue after this life: and that no more operations are to be expected from her after this life, but inſteed of them, a ſettled ſtate of *Being*; ſeeing that, euen in this life, according to Ariſtotles doctrine, the proper operations of the ſoule are but certaine *Beings*: ſo that we may conclude, that if a ſoule were growne to the perfection, which her nature is capable of, she would be nothing elſe but a conſtant *Being*, neuer changing from the happineſſe of the beſt *Being*.

And although the texts of Ariſtotle which remaine vnto vs, be vncertaine (peraduenture, not ſo much becauſe they were originally ſuch, in themſelues, as through the mingling of ſome comments into the body of the text;) yet if we had his booke which he wrote of the ſoule vpon the death of his frend Eudemus, it is very likely we should there ſee his euident aſſertion of her *Immortality*; ſince it had beene very impertinent to take occaſion vpon a frends death to write of the ſoule, if he intended to conclude, that of a dead man there were no ſoule.

10. The operations of a ſeperated ſoule compared to her operations in her bodie.

Out of this diſcourſe it appeareth, how thoſe actions which we exerciſe in this life, are to be vnderſtood, when we heare them attributed to the next: for to think that they are to be taken in their direct plaine meaning and in that way, in which they are performed in this world; were a great ſimplicity, and were to imagine a likeneſſe betweene bodies and ſpirits. We muſt therefore eleuate our mindes, when we would penetrate into the true meaning of ſuch expreſsions, and conſider how all the actions of our ſoule are eminently comprehended in the vniuerſality of know-

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ledge we haue already explicated. And ſo, the Apprehenſions, iudgements, diſcourſes, reflections, talkings together, and all other ſuch actions of ours, when they are attributed to ſeparated ſoules, are but inadæquate names and repreſentations of their inſtantaneall ſight of all thinges, for, in that, they can not chooſe, but ſee others mindes, which is that we call talking; and likewiſe their owne, which we call reflexion: the reſt are plaine partes, and are plainely contained in knowledge; diſcourſe being but the falling into it; iudgement the principles of it; and ſingle apprehenſions the cõponents of iudgements: then for ſuch actions as are the beginning of operatiõ, there can be no doubt but that they are likewiſe to be found, and are reſumed, in the ſame Vniuerſality; as, loue of good, conſultation, reſolution, prudentiall election, and the firſt motion; for who knoweth all thinges, can not chooſe but know what is good, and that good, is to be proſecuted: and who ſeeth completely all the meanes of effecting and attaining to his intended good; hath already conſulted and reſolued of the beſt: and who vnderſtandeth perfectly the matter he is to worke vpon, hath already made his prudentiall election: ſo that there remaineth nothing more to be done, but to giue the firſt impulſe.

II. That a ſeparated ſoule is in a ſtate of pure *being*, and conſequently immortall.

And thus you ſee, that this vniuerſality of knowledge in the ſoule, comprehendeth all, is all, performeth all; and no imaginable good or happineſſe, is out of her reach. A noble creature, and not to be caſt away vpon ſuch trash as moſt men employ their thoughts in. Vpon whom it is now time to reflect; and to conſider, what effects the diuers manners of liuing in this world, do worke vpon her in the next; if firſt we acquitt ourſelues of a promiſe we made at the end of the laſt Chapter. For it being now amply declared, that the ſtate of a ſoule exempted from her body, is a ſtate of pure *being*; it followeth manifeſtly, that there is neyther Action nor Paſſion in that ſtate: which being ſo, it is beyond all oppoſition that the ſoule can not dye: for it is euident that all corruption, muſt come from the action of an other thing, vpon that which is corrupted; and therefore that thing muſt be capable of being made better and of being made worſe. Now then, if a ſeparated ſoule be in a finall ſtate, where she can neyther be bettered, or worſened, (as she muſt be, if she be ſuch a thing, as we haue declared) it followeth that she can not poſſibly looſe the *Being* which she hath: and ſithence her paſſage out of the body, doth not change her nature, but only her ſtate; it is cleare, that she is of the ſame nature, euen in the body: though in this her durance, she be ſubiect to be forged (as it were) by the hammers of corporeall obiects beating vpon her; yet ſo, that of her ſelfe she ſtill is what she is. And therefore as ſoone as she is out of the paſſible oore, in which she ſuffereth by reaſon of that oore, she preſently becometh impaſsible, as being purely of her owne nature, a fixed ſubſtance, that is, a pure *Being*. Both which ſtates of the ſoule, may in ſome ſort be adũbrated by what we ſee paſſeth in the coppelling of a fixed mettall; for as long as any lead, or droſſe, or allay remaineth with it, it continueth melted, flowing, and in motion

motion vnder the muffle: but as ſoone as they are parted from it, and that it is become pure, without any mixture, and ſingly it ſelfe; it contracteth it ſelfe to a narrower roome, and at that very inſtant, ceaſeth from all motion, groweth hard, permanent, reſiſtent vnto all operations of fire, and ſuffereth no change or diminution in its ſubſtance by any outward violence we can vſe vnto it.

THE ELEVENTH CHAPTER.

Shewing what effects, the diuers manners of liuing in this world, do cauſe in a ſoule, after she is ſeparated from her body.

1. That a ſoule in this life is ſubiect to mutation, and may be perfected in knowledge.

ONe thing, may peraduenture ſeeme of hard digeſtion in our paſt diſcourſe; and it is, that out of the groundes we haue layed, it ſeemeth to follow that all ſoules will haue an equality; ſince we haue concluded, that the greateſt ſhall ſee or know no more then the leaſt: and indeed, there appeareth no cauſe why this great and noble creature, ſhould lye impriſoned in the obſcure dungeon of noyſome flesh; if in the firſt inſtant, in which it hath its firſt knowledge, it hath then already gained all whatſoeuer it is capable of gaining in the whole progreſſe of a long life afterwardes. Truly, the Platonike Philoſophers (who are perſuaded that a humane ſoule doth not profitt in this life, nor that she acquired any knowledge here; as being of her ſelfe completely perfect; and that all our diſcourſes, are but her remembringes of what she had forgotten) will find themſelues ill beſtedd to render a Philoſophicall and ſufficient cauſe of her being locked into a body: for to putt forgettfulneſſe in a pure ſpiritt; ſo palpable an effect of corporeity, and ſo great a corruption, in reſpect of a creature whoſe nature is, to know of it ſelfe, is an vnſufferable errour. Beſides, when they tell vs, that she can not be changed, becauſe all change would preiudice the ſpirituall nature, which they attribute to her; but that well she may be warned and excitated by being in a body; they meerely trifle: for eyther there is ſome true mutation made in her by that which they call a warning, or there is not; if there be not, how becometh it a warning to her? Or what is it more to her then if a ſtraw were wagged at the Antipodes? But if there be ſome mutation (be it neuer ſo litle) made in her by a corporeall motion; what ſhould hinder, why she may not by meanes of her body, attaine vnto ſcience she neuer had; as well as by it receiue any the leaſt intrinſecall mutation whatſoeuer? For if once we admitt any mutability in her from any corporeall motion, it is farre more conformable vnto reaſon to ſuppoſe it in regard of that which is her naturall perfection, and of that, which by her operations we ſee she hath immediately after ſuch corporeall motions, and whereof before them there appeared in her no markes at all; then to

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ſuppoſe it in regard of a darke intimation, of which we neyther know, it is, nor how it is performed. Surely, no Rationall Philoſopher ſeeing a thing, whoſe nature is *to know*, haue a *being*, whereas formerly it exiſted not; and obſeruing, how that thing by little and little giueth ſignes of more and more knowledge, can doubt but that as she could be changed from not *being* to *being*; ſo, may she likewiſe be changed from leſſe knowing, to more knowing.

2. That the knowledges which a ſoule getteth in this life will make her knowledge in the next life more perfect, and firme.

This then being irrefragably ſettled, that in the body she doth encreaſe in knowledge: lett vs come to our difficulty and examine what this encreaſe in the body auaileth her; ſeeing that as ſoone as she parteth from it, she shall of her owne nature enioy, and be replenished with the knowledge of all thinges: why should she laborioufly ſtriue to anticipate the getting of a few droppes, which but encreaſe her thirſt and anxiety; when hauing but a litle patience, she shall at one full and euerlaſting draught drinke vp the whole ſea of it? We know that the ſoule is a thing, made proportionably to the making of its body; ſeeing, it is the bodies compartener: and we haue concluded, that whiles it is in the body, it acquireth perfection in that way, which the nature of it is capable of; that is, in knowledge: as the body acquireth perfection its way; which is, in ſtrēgth and agility. Now then, lett vs cōpare the proceedinges of the one, with thoſe of the other ſubſtance; and peraduenture we may gaine ſome light, to diſcerne what aduantage it may proue vnto a ſoule, to remaine long in its body, if it make right vſe of its dwelling there. Lett vs cōſider the body of a man, well and exactly shaped in all his members; yet, if he neuer vſe care, nor paines to exerciſe thoſe well framed limbes of his; he will want much of thoſe corporeall perfections, which others will haue, who employ them ſedulouſly. Though his legges, armes, and handes, be of an exact ſymmetry; yet he will not be able to runne, to wreſtle, or to throw a dart, with thoſe who labour to perfect themſelues in ſuch exerciſes: though his fingers be neuer ſo neately moulded or compoſed to all aduantages of quicke and ſmart motion; yet if he neuer learned and practiſed on the lute, he will not be able with them to make any muſike vpon that inſtrument, euen after he ſeeth plainely, and comprehendeth fully all that the cunningeſt Luteniſt doth; nether will he be able to playe, as he doth with his fingers, which of themſelues are peraduenture leſſe apt for thoſe voluble motions then his are. That which maketh a man dexterous in any of theſe artes, or in any other operations proper to any of the partes or limbes of his body, is the often repetitions of the ſame actes; which do amend, and perfect thoſe limbes in their motions, and which make them fitt and ready for the actions they are deſigned vnto.

In the ſame manner it fareth with the ſoule; whoſe eſſence is that which she knoweth: her ſeuerall knowledges may be compared, to armes, handes, fingers, legges, thighes, &c, in a body: and all her knowledges taken together, do compoſe (as I may ſay) and make her vp, what she is. Now, thoſe limbes of hers, though they be, when they are at the worſt,

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worſt, entire, and well shaped in bulke (to vſe the compariſon of bodies;) yt they are ſuſceptible of further perfection, as our corporeall limbes ae, by often and orderly vſage of them. When we iterate our acts of our vnderſtanding any obiect, the ſecond act is of the ſame nature, as she firſt, the third, as the ſecond, and ſo, of the reſt: euery one of which perfecteth the vnderſtanding of that thing, and of all that dependeth vpon the knowledge of it, and maketh it become more vigorous and ſtrong; euen the often throwing of a boule at the ſame marke, begetteth ſtill more and more ſtrength and iuſtneſſe in the arme that deliuereth it: for, it can not be denyed but that the ſame cauſe which maketh any thing, muſt of neceſſity perfect and ſtrengthen it, by repeating its force and ſtroakes. We may then conclude that the knowledge of our ſoule, (which is indeed her ſelfe) will be in the next life more perfect and ſtrong, or more ſlacke and weake, according as in this life she hath often and vigorouſly, or faintly and ſeldome, buſied her ſelfe about thoſe thinges which begett ſuch knowledge.

3. That the ſoules of mē addicted to ſcience whilſt they liued here are more perfect in the next world then the ſoules of vnlearned men.

Now thoſe thinges which men beſtow their paines to know, we ſee are of two kindes: for ſome thirſt after the knowledge of nature, and of the variety of thinges, which eyther their ſenſes, or their diſcourſe, tell them of: but others looke no higher then to haue an inſight into humane action, or to gaine skill in ſome art, whereby they may acquire meanes to liue. Theſe later curioſities, are but of particulars; that is, of ſome one, or few ſpecies, or kindes, whoſe common that comprehendeth them, falleth within the reach of euery vulgar capacity; and conſequently, the thinges which depend vpon them, are low, meane, and contemptible: whereas, the beauty, vaſtneſſe, and excellency of the others, is ſo much beyond them, as they can be brought into no proportion to one an other. Now then, if we conſider, what aduantage the one ſort of theſe men, will in the next world haue ouer the other; we shall find, that they who ſpend their life here in the ſtudy and contemplation of the firſt noble obiects, will, in the next, haue their vniuerſall knowledge (that is their ſoule) ſtrong and perfect: whiles the others, that played away their thoughts and time vpon trifles, and ſeldome rayſed their mindes aboue the pitch of ſenſe, will be fainte through their former laizineſſe, like bodies benummed with the palſey, and ſickely through their ill dyett; as when a well shaped virgin, that hauing fed vpon trash inſteed of nourishing meates, languisheth vnder a weariſome burthen of the greene ſickeneſſe.

4. That thoſe ſoules which embrace vertue in this world will be moſt perfect in the next, and thoſe which embrace vice moſt miſerable.

To make this point yet more cleare, we may conſider how the thinges which we gaine knowledge of, do affect vs vnder the title of good and conuenient, in two ſeuerall manners. The one is, when the appearance of good, in the abſtracted nature of it, and after examination of all circumſtances, carryeth our hart to the deſire of the thing, that appeareth ſo vnto vs: the other is when the ſemblance of good to our owne particular perſons without caſting any further, or queſtioning whether any other

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regard may not make it preiudiciall, doth cauſe in vs a longing for the thing wherein ſuch ſemblance shineth. Now, for the moſt part the knowledges which ſpring out of the later obiects, are more cultiuated by vs, then thoſe which ariſe out of the other; partly by reaſon of their frequēt occurring, eyther through neceſſity, or through iudgement; and partly, by the addition which paſsion giueth to the impreſsions they make vpon vs: for paſsion multiplyeth the thoughts of ſuch thinges, more then of any others, if reaſon do not croſſe and ſuppreſſe her tumultuary motions, which in moſt men, she doth not. The ſoules then of ſuch perſons, as giuing way to their paſsion, do in this life buſie themſelues about ſuch thinges as appeare good to their owne perſons, and caſt no further, muſt needes decede from their bodies, vnequally builded, (if that expreſsion may be permitted me;) and will be like a lame vnwieldy body, in which the principall limbes are not able to gouerne and moue the others; becauſe thoſe principall ones are fainte, through want of ſpirits and exerciſe; and the others are ouergrowne with hidropicall and nociue humours. The reaſon whereof is that in ſuch ſoules their iudgements will be diſproportioned to one an other, one of them being vnduely ſtronger then the other. What effect this worketh in regard of knowledge, we haue already declared, and no leſſe will it haue in reſpect of action: for ſuppoſe two iudgements to be vnequall, and ſuch, as in the action one contradicteth the other; for example, lett one of my iudgements be, that it is good for me to eate becauſe I am hungry; and lett the other be, that it is good for me to ſtudy, becauſe I am shortly to giue an account of my ſelfe: if the one iudgement be ſtronger then the other, as if that of eating be ſtronger then that of ſtudying; it importeth not that there be more reaſon (all circumſtances conſidered) for ſtudying: becauſe, reaſons, do moue to action according to the meaſure in which the reſolution that is taken vpon them, is ſtrong or weake; and therefore, my action will follow the ſtrongeſt iudgement, and I shall leaue my booke to goe to my dinner.

Now, to apply this to the ſtate of a ſeparated ſoule; we are to remember how the ſpirituall iudgements, which she collected in the body, do remaine in her after she is diueſted of it: and likewiſe, we are to conſider, how all her proceeding in that ſtate, is built, not vpon paſsion, or any bodily cauſes or diſpoſitions; but meerely vpon the quality and force of thoſe ſpirituall iudgements: and then, it euidently followeth, that if there were any ſuch action in the next life, the pure ſoule would apply it ſelfe therevnto, according to the proportion of her iudgements, and as they are graduated and qualifyed. It is true, there is no ſuch action remaining in the next life; yet neuertheleſſe there remaineth in the ſoule a diſpoſition and a promptitude to ſuch action: and if we will frame a right apprehenſion of a ſeparated ſoule, we muſt conceite her to be of ſuch a nature (for then all is nature with her, as hereafter we shall diſcourſe,) as if

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she were a thing made for action in that proportion and efficacity, which the quartering of her by this variety of iudgements doth afford; that is that she is, so much the more fitt for one action then for an other, (were she to proceed to action,) as the iudgement of the goodnesse of one of these actions is stronger in her, then the iudgement of the others goodnesse, which is in effect, by how much the one is more cultiuated then the other. And out of this we may conclude, that what motions do follow in a man, out of discourse, the like will in a separated soule, follow out of her spirituall iudgements. So that as he is ioyed, if he do possesse his desired good; and is discontented and displeased, if he misse of it; and seizeth greedily vpon it when it is present to him, and then cleaueth fast vnto it, and whiles he wanteth it, no other good affecteth him, but he is still longing after that Masterwish of his heart: the like in euery regard, but much more vehemently, befalleth vnto a separated soule. So that in fine she will be happy, or miserable, according as she hath built vp her selfe, by her spirituall iudgements and affections in this life. If knowledge, and intellectuall obiects be the goods she thirsteth after what can be happier then she, when she possesseth the fullnesse of all that can be desired in that kind? But if in this world a man settleth his hart cōstantly vpon any transitory end; as vpon wealth, corporeall delights, honour, power, and the like, (which are too short breathed attendants to follow him so long a iourney as into the next;) then, all the powers of his soule, euen after she hath left her body, will be still longing after that deare Idoll of her affections; and for the want of it, she will not value the great knowledge she shall then be imbued withall, nor care for any other good she possesseth like a man who being sorrounded, with a full sea, and swolne tide of all specious obiects that may please and delight him, hath by vnluckly chance suffered his violent affections, and his impotent desires to be entangled in some meane loue, that eyther neglecteth him, or he is hindered from enioying; and thereby, that litle droppe of gall, or rather that priuation of a meane contentment (which truly in it selfe, is nothing) infecteth and poisoneth the whole draught of happynesse that but for this, would swell him vp to the height of his wishes.

5. The state of a vitious soule in the next life.

But no comparisons of sorrowes, griefes, or anguishes in this life (where our earthy dwelling doth so clogge, and allay, and dull the sense of our soule, which only feeleth and relisheth eyther delight or woe) can arriue to shadow out the misery of a separated soule so affected; whose straines are so excessiuely vehement, and whose nature is a pure actiuity, and her selfe, all sense, all knowledge. It is true, I confesse that in a man, such motions do in part proceed from passion: and therefore, I will allow, that so much of them, as haue their origine meerely and only from-thence, shall dye with the body, and shall not haue made any impression in the separated soule: but besides the streame of passion we may in such motions obserue also, the worke of reason, for she, both approueth and employeth her powers, to compasse and gaine what the other

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preſenteth;and by legitimate diſcourſe, draweth conſequences out of that principle or iudgement, which maketh the byas, it then leaneth vnto:and theſe,are vndenyable effects of a ſpirituall iudgement ſettled in the ſoule. And therefore, as farre as theſe motions proceed from ſpirituall iudgements,ſo farre,it is cleare they muſt remaine in the ſeparated ſoule.

Peraduenture, what I haue ſaid, may be lyable to a miſtake; as though I conceiued that theſe ſpirituall iudgements are made in the ſoule according to right reaſon,and to legitimate diſcourſe: whereas, I meane nothing leſſe; but eſteeming an ouerſtrong iudgement in the ſeperated ſoule, to be proportionable vnto a paſſion in the body; I conceite that as paſſion ſettleth reaſon on worke to find out meanes, whereby she may arriue vnto her endes; ſo in like manner, may this iudgement ſett reaſon on floate, with thoſe actes which follow conſequently vpon it(though inconſequent to the whole body of reaſon:) becauſe the diſorder there, is, in the exceſſe of this iudgemēt ouer others, whoſe force(according to nature)ought to be greater then it. So that, if we would frame a conception of a diſordered ſoule, when it is out of the body; we may imagine it correſpondent to a body,whoſe one part were bigger then could ſtand in proportion with an other: as, if the hand (to vſe the example we brought before) were greater then the arme could manage,or the foote were larger and heauyer, then the legge and thigh could wield:vnto which adde that euery part were actiue and working of it ſelfe;ſo as,though it could not be gouerned, yet would it continually haue its owne operation, which would be contrary to the operation of the arme,or of the legge, and conſequently, it would euer be tending to incompoſſible operations: and by that meanes, both one member would alwayes diſagree from the other,and neyther of them attaine any effect at all; not vnlike to the fanſie of the Poets, who fained a monſter, which they termed Scylla, whoſe inferiour partes, were a company of dogges, euer ſnarling and quarrelling among themſelues;and yet were vnſeuerable from one an other,as being compartes of the ſame ſubſtance.

But to declare this important doctrine more dogmatically; lett vs conſider that of neceſsity a diſordered ſoule hath theſe following iudgements ſettled in her.Namely, that she is not well; that she can not be well without her deſired good; that it is impoſsible for her to compaſſe that good;and laſtly, that this ſtate she is in, is by all meanes poſsible to be auoyded;not,by changing her iudgement (for that is her ſelfe)but by procuring the ſatisfaction she deſireth; and this with all the power,and totall inclination of her actiuity and poſsibility. This then, being the temper of a diſordered ſeparated ſoule, it is eaſy to conceiue, what a ſad condition ſuch an one remaineth then in; which is infinitely more,then any affliction that can happen to a man in this world: for ſince,euen here,all our ioyes,and griefes,do proceed from our ſoule; we muſt

muſt needes allow, that when she shall be free from the burthen of her body (which doth exceedingly impeach, and limitt her operations, and actiuity) all her actions will be then farre greater and more efficacious.

But becauſe this point is of higheſt conſequence, we may not ſlightly paſſe it ouer; but we will endeauour, if we can, to diſcouer the wonderfull efficacity and force of a ſeparated ſoules operations; that from thence we may the better collect, how great her happeneſſe or miſery will be in the next life. Lett vs then conſider, how an act or iudgement of the ſoule, may be more forcible, eyther by it ſelfe, or by the multiplication of ſuch helpes, as do concurre with it. To beginne with conſidering the act in it ſelfe, we know that the certaineſt way to meaſure the ſtrength of it, is to take a ſuruey of the force which sheweth it ſelfe in its effect: for they being relatiues to one an other, each of them diſcouereth the others nature. Now, this we will do after our ordinary manner, by comparing the ſpirituall effects iſſuing from a iudgement in the ſoule, to materiall effects proceeding from the operations and motions of bodies. In theſe we may obſerue three thinges, by which we may eſtimate their efficaciouſneſſe: ſome actions dure a longer time; others, take vp a greater place; and others againe, worke the like effect in a greater place, and in a shorter time: which laſt ſort, of all others, do proceed from the moſt powerfull, and moſt forcible agents. If then in theſe conſiderations, we compare a ſeparated ſoule to a body; what an infinity of ſtrength and efficacity, will the meaneſt of thoſe pure ſubſtances haue, beyond the moſt powerfull and actiue body that can be imagined in nature? For we haue already shewed, how a ſeparated ſoule comprehendeth at once, all place, and all times: ſo that, her actiuity requireth no application to place or time; but, she is, of her ſelfe, miſtreſſe of both, comprehending all quantity whatſoeuer, in an indiuiſible apprehenſion; and ranking all the partes of motion, in their complete order; and knowing at once, what is to happen in euery one of them. On the other ſide; an incorporated ſoule, by reaſon of her being confined to the vſe of her ſenſes, can looke vpon but one ſingle definite place, or time, at once; and needeth a long chaine of many diſcourſes, to comprehend all the circumſtances of any one action: and yet after all, how short she is of comprehending all? So that comparing the one of theſe with the other, it is euident, that in reſpect of time and place; and in reſpect of any one ſingular action; the proportion of a ſeparated ſoule, to one in the body, is as all time, or all place, in reſpect of any one piece, or leaſt parcell of them; or as the entire abſolute comprehender of all time and all place, is to the diſcouerer of a ſmall meaſure of them. For whatſoeuer a ſoule willeth in that ſtate, she willeth it for the whole extent of her duration; becauſe she is then out of the ſtate or capacity of changing: and wisheth for whatſoeuer she wisheth, as for her abſolute good; and therefore employeth the whole force of her iudgement, vpon euery particular wish. Likewiſe the eminency which a ſeparated ſoule hath ouer place, is alſo then entirely

6. The fundamentall reaſon why as well happineſſe as miſerie is ſo exceſſiue in the next life.

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employed vpon euery particular wish of hers; since in that state there is no variety of place left vnto her, to wish for such good in one place, and to refuse it in an other; as, whiles she is in the body happeneth to euery thing she desireth. Wherefore, whatsoeuer she then wisheth for, she wisheth for it according to her comparison vnto place: that is to say; that as such a soule hath a power to worke at the same time in all place by the absolute comprehension, which she hath of place in abstract: so euery wish of that soule, if it were concerning a thing to be made in place, were able to make it in all places; through the excessiue force and efficacy which she employeth vpon euery particular wish. The third effect by which among bodies we gather the vigour, and energy of the cause that produceth it, (to witt, the doing of the like action, in a lesser time, and in a larger extent,) is but a combination of the two former: and therefore, it requireth no further particular insistance vpon it, to shew, that likewise in this, the proportion of a separated to an incorporated soule, must needes be the selfe same as in the others; seeing that a separated soules actiuity, is vpon all place in an indiuisible of time.

Therefore, to shutt vp this point; there remaineth only for vs to consider, what addition may be made vnto the efficacity of a iudgement, by the concurrence of other extrinsecall helpes: We see that when an vnderstanding man will settle any iudgement, or conclusion in his mind, he weigheth throughly all that followeth out of such a iudgement; and considereth likewise all the antecedents that lead him vnto it: and if after due reflection, and examination, of whatsoeuer concerneth that conclusion, which he is establishing in his mind, he findeth nothing to crosse it, but that euery particular and circumstance goeth smoothly along with it, and strengtheneth it; he is then satisfyed, and quiett in his thoughts, and yieldeth a full assent therevnto: which assent is the stronger, by how many the more concurrent testimonyes he hath for it. And although he should haue a perfect demonstration or sight of the thing in it selfe, yet euery one of the other extrinsecall proofes, being as it were a new persuasion, hath in it a further vigour to strengthen and content his mind in the forehad demonstration: for, if euery one of these be in it selfe sufficient to make the thing euident; it can not happen that any one of them, should hinder the others: but contrariwise, euery one of them, must needes coucurre with all the rest, to the effectuall quieting of his vnderstanding, in its assent, to that iudgement. Now then, according to this rate, lett vs calculate, (if we can) what concurrence of proofes and wittnesses a separated soule will haue to settle and strengthen her in euery one of her iudgemẽts. We know, that all veritiesare chained, and connected one to an other; and that there is no true conclusion so farre remote from any other, but may by more, or lesse consequences and discourses, be deduced euidently out of it: it followeth then that in the abstracted soule, where all such consequences are ready drawne, and seene in themselues without extension of time, or

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employing of paines to collect them; euery particular verity, beareth testimony to any other: so that euery one of them is beleeued, and worketh in the force and vertue of all. Out of which it is manifest, that euery iudgement in such a separated soule, hath an infinite strength and efficacity ouer any made by an embodyed one.

To summe all vp in a few wordes: we find three rootes of infinity in euery action of a separated soule, in respect of one in the body: first, the freedome of her essence or substance in it selfe: next, that quality of hers, by which she comprehendeth place and time; that is, all permanent and successiue quantity: and lastly, the concurrence of infinite knowledges to euery action of hers. Hauing then this measure in our handes, lett vs apply it to a well ordered, and to a disordered soule passing out of this world: lett vs consider the one of them, sett vpon those goodes, which she shall there haue present and shall fully enioy: the other, languishing after, and pining away for those, which are impossible for her euer to obtaine. What ioy, what content, what exultation of mind, in any liuing man, can be conceiued so great, as to be compared with the happinesse of one of these soules? And what griefe, what discontent, what misery, can be like the others?

7. The reason why mans soule requireth to be in a body, and to liue for some space of time ioyned with it.

These are the different effects, which the diuers manners of liuing in this world, do cause in soules after they are deliuered from their bodies: out of which, and out of the discourse that hath discouered these effects vnto vs, we see a cleare resolution of that so maine and agitated question among the Philosophers, why a rationall soule is imprisoned in a grosse body of flesh and bloud? In truth, the question is an illegitimate one; as supposing a false ground: for, the soules being in the body, is not an imprisonnement of a thing that was existent before the soule and body mett together; but her being there, is the naturall course of beginning that, which can no other way come into the listes of nature: for should a soule, by the course of nature, obtaine her first being without a body, eyther she would in the first instant of her being, be perfect in knowledge, or she would not: if she were, then would she be a perfect and complete immateriall substance, not a soule; whose nature is to be a compartner to the body, and to acquire her perfection by the mediation and seruice of corporeall senses: but if she were not perfect in science, but were only a capacity therevnto, and like vnto white paper, in which nothing were yet w itten; then, vnlesse she were putt in a body, she could neuer arriue to know any thing, because motion and alteration are effects peculiar to bodies: therefore, it must be agreed, that she is naturally designed to be in a body: but her being in a body, is her being one thing with the body, she is said to be in: and so she is one part of a whole, which from its weaker part is determined to be a body.

Againe, seeing that the matter of any thing, is to be prepared, before the end is prepared, for which that matter is to serue; according to that Axiome, *Quod est primum in intentione, est vltimum in executione:*

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we may not deny, but that the body is in being, ſome time before the ſoule: or at the leaſt, that it exiſteth as ſoone as she doth: and therefore, it appeareth wholy vnreaſonable, to ſay, that the ſoule was firſt made out of the body, and was afterwardes thruſt into it; ſeeing that the body was prepared for the ſoule before, or at the leaſt, as ſoone as she had any beginning: and ſo we may conclude, that of neceſſity the ſoule muſt be begunne, layed, hatched, and perfected in the body.

And although it be true, that ſuch ſoules, as are ſeparated from their bodies, in the firſt inſtant of their being there, are notwithſtanding imbued with the knowledge of all thinges; yet is not their longer abode there in vaine: not only, becauſe thereby the ſpecies is multiplyed; (for nature is not content with barely doing that, without addition of ſome good to the ſoule it ſelfe) but as well for the wonderfull, and I may ſay infinite aduantage, that may thereby accrew to the ſoule, if she make right vſe of it: for, as any act of the abſtracted ſoule is infinite, in compariſon of the acts which men exercise in this life, (according to what we haue already shewed) ſo by conſequence, muſt any encreaſe of it, be likewiſe infinite: and therefore we may conclude, that a long life well ſpent, is the greateſt and moſt excellent guift, which nature can beſtow vpon a man.

8. That the miſery of the ſoule in the next world, proceedeth out of inequality, and not out of falſity of her iudgements.

The vnwary reader may perhapps haue difficulty, at our often repeating of the infelicity of a miſerable ſoule; ſince we ſay, that it proceedeth out of the iudgements, she had formerly made in this life; which without all doubt were falſe ones: and neuertheleſſe, it is euident, that no falſe iudgements, can remaine in a ſoule, after she is ſeparated from her body; as we haue aboue determined. How then can a ſoules iudgements, be the cauſe of her miſery? But the more heedefull reader, will haue noted, that the miſery which we putt in a ſoule, proceedeth out of the inequality, not out of the falſity, of her iudgements: for if a man be inclined to a leſſer good, more then to a greater, he will in action betake himſelfe to the leſſer good, and deſert the greater, (wherein, neyther iudgemēt is falſe, nor eyther inclination is naught) meerely out of the improportion of the two inclinations or iudgements to their obiects: for that a ſoule may be duely ordered, and in a ſtate of being well, she muſt haue a leſſer inclination to a leſſe good, and a greater inclination to a greater good: and in pure ſpirits, theſe inclinations are nothing elſe, but the ſtrength of their iudgements: which iudgements in ſoules, whiles they are in their bodies, are made by the repetition of more acts from ſtronger cauſes, or in more fauourable circumſtances. And ſo it appeareth, how without any falſity in any iudgement, a ſoule may become miſerable, by her conuerſation in this world; where all her inclinations generally are good, vnleſſe the diſproportion of them, do make them bad.

THE

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THE TWELFTH CHAPTER.

Of the perſeuerance of a ſoule, in the ſtate she findeth her ſelfe in, at her firſt ſeparation from her body.

THus we haue brought mans ſoule, out of the body she liued in here, and by which she conuerſed, and had commerce with the other partes of this world: and we haue aſſigned her, her firſt array and ſtole, with which she may be ſeene in the next world: ſo that now there remaineth only for vs to conſider, what shall betide her afterwardes; and whether any change may happen to her, and be made in her, after the firſt inſtant of her being a pure ſpiritt, ſeparated from all conſortshippe with materiall ſubſtances. To determine this point the more clearely, lett vs call to minde, an axiome that Ariſtotle giueth vs in his logike; which teacheth vs, *That as it is true, if the effect be, there is a cauſe; ſo likewiſe it is moſt true, that if the cauſe be in act, or cauſing, the effect muſt alſo be.* Which *Axiome* may be vnderſtood two wayes: the one, that if the cauſe hath its effect, then the effect alſo is: and this is no great myſtery; or for it, are any thankes due to the teacher; it being but a repetition, and ſaying ouer againe of the ſame thing. The other way is, that if the cauſe be perfect in the nature of being a cauſe, then the effect is: which is as much as to ſay, that if nothing be wãting to the cauſe, abſtracting preciſely from the effect; then neyther is the effect wanting. And this is the meaning of Ariſtotles Axiome: of the truth and euidence whereof in this ſenſe, if any man should make the leaſt doubt, it were eaſy to euince it: as thus; if nothing be wanting but the effect, and yet the effect doth not immediately follow, it muſt needes be, that it can not follow at all; for if it can, and doth not, then ſomething more muſt be done to make it follow: which is againſt the ſuppoſition, that nothing was wanting but the effect; for that which is to be done, was wanting. To ſay, it will follow without any change, is ſenſeleſſe: for if it follow without change, it followeth out of this, which is already putt: but if it do follow out of this which is preciſely putt, then it followeth, againſt the ſuppoſition, which was, that it did not follow although this were putt.

1. The explication, and proofe of that maxime, that, *if the cauſe be in act, the effect muſt alſo be.*

This then being euident, lett vs apply it to our purpoſe; and lett vs putt three or more thinges, namely A. B. C. and D: whereof none can worke otherwiſe, then in an inſtant or indiuiſibly: and I ſay, that whatſoeuer theſe foure thinges are able to do, without reſpect to any other thing beſides them, is completely done in the firſt inſtant of their being putt: and if they remayne for all eternity, without communication or reſpect to any other thing, there shall neuer be any innouation in any of them, or any further working among them: but they will alwayes

2. The effects of all ſuch agents as worke inſtantaneouſly, are complete in the firſt inſtant that the agents are putt.

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remayne immutable, in the same state they were in, at the very first instant of their being putt: for whatsoeuer A can doe, in the first instant, is in that first instant actually done; becausse he worketh indiuisibly: and what can be done precisely by A, and by his action ioyned to B; doth precisely follow out of A, and his action, and out of B, and his action, if B haue any action independent of A: and becausse all these are in the same instant, whatsoeuer followeth precisely out of these, and out of any thing else that is in the same instant, and that worketh indiuisibly as they do; is necessarily done in that very instant: but all the actions of C and D, and of whatsoeuer by reflection from them may be done by A and B, being all of them indiuisible, and following precisely out of some of the forenamed actions; they do follow out of thinges being in this instant: and becausse they are indiuisible, they may be in this instant: and therefore, all is done in this instant. Now, supposing all to be done that can be done by them in this instant; and that nothing can follow from them, vnlesse it follow precisely out of what is in this instant; and that it is all indiuisible: it followeth clearely, that whatsoeuer (concerning them) is not in this instant, can neuer be.

3. All pure spirits do worke instantaneously.

These two conclusions being thus demonstrated; lett vs in the next place determine, how all actions of pure spirits, which haue no respect to bodies, must of necessity be indiuisible; that is, must include no continuate succession: by which, I meane such a succession, as may be deuided into partes without end: for if we looke well into it, we shall find, that a continuate succession can not be a thing, which hath in it selfe a *Being*: and the reason is, becausse the essence of such a succession, consisteth in hauing some of its partes already *passed*, and others of them yet to come: but on the other side, it is euident, that no such thing can be, whose essentiall ingredients are not it selfe: and therefore it followeth euidently, that such a thing as we call succession, can haue no being in it selfe: seeing that one essentiall part of it, neuer is with the other: therefore, such a succession, must haue its being in some permanent thing, which must be diuisible; for that is essentially required in succession: but permanent diuisibility is that which we call Biggenesse or Quantity; from which pure spirits are free: and therefore, it is most euident, that all their actions in respect of themselues, are absolutely indiuisible.

4. That a soule separated from her body can not suffer any change after the first instant of her separation.

Now, to make vse of this doctrine to our intent: we say, that since our soule, when it is separated from our body, is a pure spiritt or vnderstanding; and that all her actions are indiuisible; and that all actiõs of other spirits vpõ her must likewise be such; and by cõsequence, that there can be no continuate succesion of action among them: we must of necesity conclude, that according to the priuate nature of the soule, and according to the common notion of spirituall thinges; there can be no change made in her, after the first instant of her parting from her body: but, what happinesse or misery betideth her in that instant, continueth with her for all eternity. Yet is it not my mind to say, that by

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the course of the vniuersall resolutions, from which she is not wholy exempt, and from supernaturall administration of corporeall thinges, there may not result some change in her. But the consideration of that matter, I remitt to those treatises, vnto which it belongeth; as not depending, nor ensuing from the particular nature of the soule: and therefore, not falling vnder our discussion in this place.

This same conclusion may be proued by an other argument, besides this which we haue now vsed: and it is this. Whatsoeuer worketh purely by vnderstanding and minde, can not be changed in its operations, vnlesse its vnderstanding or minde be altered: but this can not happen, vnlesse eyther it learne somewhat, it knew not before; or forgetting a foreknowne truth, it beginne afterwardes to thinke a falsity. This second part, is impossible, as we haue already shewed, when we proued that falsehood could haue no admittance into a separated soule: and the former is as impossible: it being likewise proued, that at her first instant of her separation, she knoweth all thinges: wherefore, we may hence confidently conclude, that no change of minde, (that is no change at all) can happen to an abstracted soule.

5. That temporall sinnes are iustly punished with eternall paines.

And thus, by discourse, we may arriue, to quitt ourselues easily of that famous obiection, so much pestering Christian Religion; how God, can in iustice impose eternall paines vpon a soule, for one sinne, acted in a short space of time. For we see, it followeth by the necessary course of nature, that if a man dye in a disorderly affection to any thing, as to his chiefe good, he eternally remaineth by the necessity of his owne nature, in the same affection: and there is no imparity, that to eternall sinne, there should be imposed eternall punishment.

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THE CONCLVSION.

AND now I hope, I may confidently say, I haue beene as good as my word: and I doubt not, but my Reader will finde it so, if he spend but halfe as much time in perusing these two treatises, as the composing them hath cost me. They are too nice (and indeede, vnreasonable) who expect to attaine without paines, vnto that, which hath cost others yeares of toyle. Lett them remember the wordes of holy Iob, that *wisedome is not found in the land of those, that liue at their ease.* Lett them cast their eyes on every side round about them, and then tell me, if they meete with any employment, that may be compared to the attaining vnto these, and such like principles; whereby a man is enabled to gouerne himselfe vnderstandingly and knowingly, towards the happinesse, both of the next life and of this; and to comprehend the wisemans theme; *what is good for a man in the dayes of his vanity, whiles he playeth the stranger vnder the sunne.* Lett vs feare Gods Iudgements. Lett vs carefully pursue the hidden bounties, he hath treasured vp for vs. Lett vs thanke him for the knowledge he hath giuen vs: and admire the excellency of Christian Religion; which so plainely teacheth vs that, vnto which it is so extreme hard to arriue by natural meanes. Lett vs blesse him, that we are borne vnto it. And lett vs sing to him; *That it is he, who preacheth his doctrine to Iacob, and giueth his lawes to Israël. He hath not done the like to all nations; nor hath he manifested his secret truthes vnto them.*

BVT before I cutt of this thridde, which hath cost me so much paines to spinne out to this Length; I must craue my Readers leaue, to make some vse of it, for my owne behoofe. Hitherto my discourse hath beene directed to him: now I shall entreate his patience, that I may reflect it in a word or two vpon my selfe. And as I am sure I haue profited my selfe not a litle, by talking all this while to him, that obliging me to polish my conceptions with more care, and to range them into better order, then whiles they were but rude meditations with in my owne breast; so I hope, that a litle, conuersation with my selfe vpon this important subiect, (which is to be studied for vse, and practise; not for speculatiue science) may prooue aduantagious vnto him; if his warmed thoughts haue tuned his soule to such a key, as I am sure these considerations haue wound vp mine vnto.

To thee then my soule, I now addresse my speech. For since by long debate, and toylesome rowing against the impetuous tydes of ignorance, and false apprehentions, which ouerflow thy bankes, and hurry

hurry thee headlong downe the ſtreame, whileſt thou art impriſoned in thy clayie manſion; wee haue with much adoe arriued to ayme att ſome litle atome of thy vaſt greatneſſe; and with the hard and tough blowes of ſtrict and wary reaſoning, we haue ſtrucken out ſome few ſparkes of that glorious light, which inuironeth and ſwelleth thee, or rather, which is thee: it is high time, I should retire my ſelfe out of the turbulent and ſlippery field of eager ſtrife and litigious diſputation, to make my accounts with thee; where no outward noiſe may diſtract vs, nor any way intermeddle betweene vs, excepting only that eternall verity, which by thee shineth vpon my faint and gloomy eyes; and in which I ſee, whatſoeuer doth or can content thee in me. I haue diſcouered, that thou (my ſoule) wilſt ſuruiue me: and ſo ſuruiue me, as thou wilſt alſo ſuruiue the mortality, and changes which belong to me; and which are but accidentary to thee, meerely becauſe thou art in me. Then shall the viciſſitude of time, and the inequality of diſpoſitions in thee, be turned into the conſtancy of immortality; and into the euenneſſe of one being, neuer to end, and neuer to receiue a change, or ſucceſſion to better or worſe.

When my eye of contemplation, hath beene fixed vpon this bright ſunne, as long as it is able to endure the radiant beames of it; whoſe redundant light veyleth the looker on, with a darke miſt: lett me turne it for a litle ſpace, vpon the ſtraight paſſage, and narrow gullet, through which thou ſtriueſt (my ſoule) with faint and weary ſteppes, during thy hazardous voyage vpon the earth, to make thy ſelfe a way: and lett me examine, what compariſon there is, betweene thy two conditions; the preſent one, wherein thou now findeſt thy ſelfe immerſed in flesh and bloud; and the future ſtate that will betide thee, when thou shalſt be melted out of this groſſe oore, and refined from this meane alloy. Lett my terme of life, be of a thouſand long yeares; longer then euer happened to our aged forefathers, who ſtored the earth with their numerous progeny, by out liuing their skill to number the diffuſed multitudes, that ſwarmed from their loines: lett me, during this long ſpace, be ſole Emperour and abſolute Lord, of all the huge globe of land and water, encompaſſed with Adams offspring: lett all my ſubiects lye proſtrate at my feete, with obedience and awe, diſtilling their actiueſt thoughts, in ſtudying day and night to inuent new pleaſures and dilights for me: lett nature conſpire with them, to giue me a conſtant and vigorous health; a perpetuall ſpring of youth, that may to the full, relish whatſoeuer good all they can fancy: lett graueſt Prelates, and greateſt Princes, ſerue inſteed of flatterers to highten my ioyes; and yet thoſe ioyes, be rayſed aboue their power of flattery: lett the wiſemen of this vaſt family (whoſe ſentiments, are maximes and oracles, to gouerne the worldes beliefes and actions) eſteeme, reuerence, and adore me in the ſecreteſt, and the moſt recluſe withdrawings of their hartes: lett all the wealth, which to this very day, hath euer beene torne out of the

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bowels of the earth; and all the treasures, which the sea hideth from the view of greedy men, swell round about me; whilest all the world besides, lyeth gaping to receiue the crummes, that fall neglected by me, from my full loaden table: lett my imagination be as vast, as the vnfathomed Vniuerse; and lett my felicity be as accomplished, as my imagination can reach vnto; so that wallowing in pleasure, I bee not able to think how to increase it, or what to wish for more, then that which I possesse and enioy.

Thus when my thoughts are at a stand, and can raise my present happinesse no higher; lett me call to minde, how this long lease of pleasant dayes, will in time come to an end: this bottome of a thousand ioyfull yeares, will att length be vnwound, and nothing remaine of it: and then (my soule) thy infinitely longer liued Immortality will succeed; thy neuer ending date, will beginne a new account, impossible to be summed vp, and beyond all proportion infinitely exceeding the happinesse, we haue rudely aymed to expresse: so that no comparison can be admitted betweene them. For, suppose first that such it were, as the least and shortest of those manifold ioyes, which swell it to that height we haue fancyed, were equall to all the contentment thou shalst enioy in a whole million of yeares; yet millions of yeares may be so often multiplyed, as att length, the slender and limited contentments supposed in them, may equalyse, and outgoe the whole heape of ouerflowing blisse, raysed so high, in the large extent of these thousand happy yeares. Which when they are cast into a totall summe; and that I compare it, with the vnmeasurable eternity, which only measureth thee; then *I* see, that all this huge product of Algebraicall multiplication, appeareth as nothing, in respect of thy remayning, and neuer ending suruiuance; and is lesse, then the least point in regard of the immense Vniuerse. But then, if it be true (as it is most true) that thy least sparke and moment of reall happinesse, in that blessed eternity thou hopest for, is infinitely greater, and nobler, then the whole masse of fancyed ioyes, of my thousand yeares life here on earth; how infinitely will the valew of thy duration, exceed all proportion, in regard of the felicity, I had imagined my selfe? And seing there is no proportion betweene them, lett me sadly reflect vpon my owne present condition: lett me examine what it is, I so busily, and anxiously, employ my thoughts and pretious time vpon: lett me consider my owne courses, and whither they leade me: lett me take a suruay of the liues, and actions, of the greatest part of the world, which make so loude a noise about my eares: and then may I iustly sigh out from the bottome of my anguished hart; to what purpose haue I hitherto liued? To what purpose are all these millions of toilesome auntes, that liue and labour about me? To what purpose were Cesars and Alexanders? To what purpose Aristotles and Archimedeses? How miserably foolish are those conquering tyrants, that diuide the world with their lawlesse swords? What sēseleſſe idiots those acute Philosophers, who

who teare mens wittes in pieces, by their different wayes, and ſubtile Logicke; ſtriuing to shew men beatitudes in this world, and ſeeking for that, which if they had found, were but a nothing of a nothing in reſpect of true beatitude? He only is truly wiſe, who neglecting all that flesh and bloud deſireth, endeauoreth to purchaſe att any rate this felicity, which thy ſuruiuance promiſeth: the leaſt degree of which, ſo farre ſurmounteth all the heapes, which the gyants of the earth are able to raiſe, by throwing hils vpon hils, and ſtriwing in vaine to ſcale and reach thoſe eternities, which reſide aboue the skyes. Alas, how fondly doth mankinde ſuffer it ſelfe to be deluded? How true it is, that the only thing neceſſary, proueth the only thing that is neglected? Looke vp my ſoule, and fixe thine eye vpon that truth, which eternall light maketh ſo cleere vnto thee, shining vpon thy face with ſo great euidence, as defyeth the noonetyde ſunne, in its greateſt brightneſſe. And this it is, that euery action of thine, be it neuer ſo ſlight, is mainely miſchieuous; or be it neuer ſo bedeckt, with thoſe ſpecious conſiderations, which the wiſe men of the world iudge important, is foolish, abſurd, and vnworthy of a man; and vnworthy of one that vnderſtandeth, and acknowledgeth thy dignity; if in it there be any ſpecke; or if through it, there appeare any ſparke of thoſe meane and flatte motiues, which with a falſe byas, draw any way aſide, from attaining that happineſſe, we expect in thee. That happineſſe, ought to be the end, and marke we leuell att: that, the rule and model of all our actions: that, the meaſure of euery circumſtance, of euery atome, of whatſoeuer we beſtow ſo pretious a thing vpon, as the employment of thee is.

But we muſt not ſo ſlightly paſſe ouer the intenſeneſſe and vehemence of that felicity, which thou (my ſoule) shalt enioy, when thou art ſeuered from thy benumming compartner. I ſee euidently, that thou doſt not ſuruiue, a ſimple and dull eſſence; but art replenished with a vaſt and incomprehenſible extent of riches and delight within thy ſelfe. I ſee that golden chayne, which here by long diſcourſes, filleth huge volumes of bookes, and diueth into the hidden natures of ſeuerall bodies; in thee reſumed into one circle or linke, which containeth in it ſelfe the large ſcope of whatſoeuer ſcrewing diſcourſe can reach vnto. I ſee it comprehend, and maſter the whole world of bodies. I ſee euery particular nature, as it were emboſſed out to the life, in thy celeſtiall garment. I ſee euery ſolitary ſubſtance ranked in its due place and order, not crushed or thronged by the multitude of its fellowes; but each of them in its full extent, in the full propriety of euery part and effect of it; and diſtinguished into more diuiſions, then euer nature ſeuered it into. In thee I ſee an infinite multitude enioy place enough. I ſee, that neither hight, nor profundity, nor longitude, nor latitude, are able to exempt themſelues from thy diffuſed powers: they faddome all; they comprehend all; they maſter all; they enriche thee with the ſtock of all; and thou thy ſelfe art all, and ſomewhat more then all; and yet, now but

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one of all. I ſee, that eueryone of this all, in thee encreaſeth the ſtrength, by which thou knoweſt any other of the ſame all: and all, encreaſeth the knowledge of all, by a multiplication beyond the skill of Arithmetike; being (in its kind) abſolutely infinite; by hauing a nature, that is incapable of being eyther infinite or finite. I ſee againe, that thoſe thinges which haue not knowledge, are ſituated in the loweſt, and meaneſt ranke of creatures; and are in no wiſe comparable to thoſe which know. I ſee, there is no pleaſure att all, no happineſſe, no felicity, but by knowledge, and in knowledge. Experience teacheth me, how the purer, and nobler race of mankind, adoreth in their hartes, this idole of knowledge, and ſcorneth what euer elſe they ſeeme to court, and to be fond of. And I ſee, that this exceſſe of ſea of knowledge which is in thee, groweth not by the ſucceſſion of one thought after an other; but is like a full ſwolne ocean, neuer ebbing on any coaſt, but equally pushing att all its boundes, and tumbling out its flowing waues on euery ſyde, and into euery creche; ſo that euery where it maketh high tide. Or like a pure ſunne, which from all partes of it, shooteth its radiant beames with a like extremity of violence. And I ſee likewiſe, that this admirable knowledge, is not begotten and conſerued in thee, by the accidentary helpe of defectiue cauſes; but is rooted in thy ſelfe; is ſteeped in thy owne eſſence, like an vnextinguishable ſourſe of a perpetually ſtreaming fire; or like the liuing head of an euerrunning ſpring; beholden to none, out of thy ſelfe, ſauing only to thy Almighty Creatour; and begging of none; but being in thy ſelfe all that of which thou shouldeſt begge.

This then (my ſoule) being thy lotte; and ſuch a hieght of pleaſure being reſerued for thee; and ſuch an extremity of felicity, with in a short ſpace attending thee; can any degenerate thought, euer gaine ſtrength enough; to shake the euidence which theſe conſiderations implant and riuett in thee? Can any dull obliuion deface this ſo liuely and ſo beautifull image? Or can any length of time, draw in thy memory a veyle betweene it, and thy preſent attention? Can any peruerſity, ſo diſtort thy ſtraight eyes, that thou shouldeſt not looke allwayes fixed vpon this marke; and leuell thy ayme directly at this white? How is it poſſible, that thou canſt brooke to liue, and not expire preſently, thereby to ingulfe thy ſelfe, and be throughly imbibed with ſuch an ouerflowing bliſſe? Why doſt thou not breake the walles and chaynes of thy flesh and bloud, and leape into this glorious liberty? Here Stoickes, you are to vſe your ſwords. Vpon theſe conſiderations, you may iuſtifie the letting out the bloud, which by your diſcourſes, you ſeeme ſo prodigall of. To dye vpon theſe termes, is not to part with that, which you fondly call a happy life; feeding your ſelues, and flattering your hearers with empty words: but rather it is, to plunge yourſelues into a felicity, you were neuer able to imagine, or to frame in your miſguided thoughts any ſcantling of.

But nature pulleth me by the eare, and warneth me from being ſo wrongfull

wrongfull to her, as to conceiue, that so wise a gouernesse should to no aduantage, condemne mankinde to so long a bannishment, as the ordinary extent of his dull life, and wearisome pilgrimage here vnder the sunne reacheth vnto. Can we imagine, she would allow him so much laysie time, to effect nothing in? Or can wee suspect, that she intended him no further aduantage, then what an abortiue child arriueth vnto in his mothers wombe? For whatsoeuer the nettes and toyles of discourse can circle in; all that he, who but once knoweth that himselfe is, can attaine vnto as fully, as he that is enriched with the science of all things in the world. For, the connexion of things, is so linked together, that proceeding from any one, you reach the knowledge of many; and from many, you cannot faile of attaining vnto all: so that a separated soule, which doth but know herselfe, can not choose but know her body too; and from her body, she cannot misse in proceeding from the causes of them both, as farre as immediate causes do proceede from others ouer them: and as litle can she be ignorant, of all the effects of those causes she reacheth vnto. And thus, all that huge masse of knowledge, and happinesse, which we haue cõsidered in our last reflexion, amounteth to no more, then the seeliest soule buried in warme blood, can and will infallibly attaine vnto, when its time cometh. Wee may then assure our selues, that iust nature hath prouided and designed a greater measure of such felicity for longer liuers: and so much greater, as may well be worth the paines and hazards, of so miserable and tedious a passage, as here (my soule) thou strugglest through. For certainely, if the dull percussion, which by natures institution, hammereth out a spirituall soule from grosse flesh and bloud, can atcheiue so wondrous an effect, by such blunt instruments, as are vsed in the contriuing of a man; how can it be imagined, but that fifty or a hundred yeares beating vpon farre more subtile elements, refined in so long a time, as a child is becoming a man, and arriuing to his perfect discourse, must necessarily forge out in such a soule, a strange and admirable excellency, aboue the vnlicked forme of an abortiue embryon? Surely, those innumerable strokes (euery one of which maketh a strong impression in the soule, vpon whom they beate) cannot choose but worke a mighty difference, in the subiect that receiueth them, changing it strangely from the condition it was in, before they begunne to new mould it. What if I should say, the oddes betweene two such soules, may peraduenture be not vnlike the difference, betweene the wittes and iudgements of the subtilest Philosopher that euer was, and of the dullest child or idiote liuing. But this comparison falleth too short by farre: euen so much, that there is no resemblance or proportion betweene the thinges compared; for as the excesse of great numbers ouer one an other, drowneth the excesse of small ones, and maketh it not considerable, in respect of theirs, although they should be in the same proportion; so the aduantages of a soule, forged to its highest perfection in a mans body, by its long abode

there, and by its making right vſe of that pretious time allowed it; muſt needes, (in poſitiue valew, though not in geometricall proportion) infinitely exceed, when it shall be deliuered out of priſon, the aduantages, which the newly hatched ſoule of an abortiue infant shall acquire, att the breaking of its chaines. In this caſe, I beleeue no man would be of Ceſars mind; when he wished to be rather the firſt man in a contemptible poore village, he paſſed through among the deſert mountains, then the ſecond man in Rome. Lett vs ſuppoſe, the wealth of the richeſt man in that barren habitation, to be one hundred Crownes; and that the next to him in ſubſtance, had but halfe as much as he: in like manner, in that opulent citty, the head of the world, where millions were as familiar as pence in other places, lett the exceſſe of the richeſt mans wealth, be but (as in the former) double ouer his, that cometh next vnto him; and there you shall find, that if the pooreſt of the two, be worth fifty millions, the other hath fifty millions more then he: whereas the formers petty treaſure, exceedeth his neighbours but by fifty crownes. What proportion is there, in the common eſtimation of affaires, betweene that triuiall ſumme, and fifty millions? Much leſſe is there, betweene the excellency of a ſeparated ſoule, firſt perfected in its body, and an other that is ſett looſe into complete liberty, before its body arriued in a naturall courſe, to be deliuered into this world, and by its eyes to enioy the light of it. The change of euery ſoule att its ſeparation from the body, to a degree of perfectiō, aboue what it enioyed in the body, is in a manner infinite: and by a like infinite proportion, euery degree of perfection it had in the body, is alſo then multiplyed: what a vaſt product then of infinity, muſt neceſſarily be rayſed, by this multiplying inſtāt of the ſoules attaining liberty, in a well moulded ſoule; infinitely beyond that perfection, which the ſoule of an infant dying before it be borne, arriueth vnto? And yet we haue determined that to be a in manner infinite. Here our skill of Arithmetike and proportions fayleth vs. Here wee find infinite exceſſe, ouer what we alſo know to be infinite. How this can be, the feeble eyes of our limited vnderſtanding, are too dull to penetrate into: but that it is ſo, we are ſure: the rigour of diſcourſe, conuinceth and neceſſarily concludeth it. That aſſureth vs, that ſince euery impreſſion vpon the ſoule, whiles it is in its body, maketh a change in it; were there no others made, but meerely the iterating of thoſe actes, which brought it from ignorance to knowledge; that ſoule, vpon which a hundred of thoſe actes had wrought, muſt haue a hundred degrees of aduantage ouer an other, vpon which only one had beaten; though by that one, it had acquired perfect knowledge of that thing: and then in the ſeparation, theſe hundred degrees, being each of them infinitely multiplyed, how infinitely muſt ſuch a ſoule exceed in that particular, (though we know not how) the knowledge of the other ſoule; which though it be perfect in its kind, yet had but one act to forge it out? When wee arriue to vnderſtand the difference

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of knowledge, betweene the ſuperiour and inferiour rankes of intelligences; among whome, the loweſt knoweth as much as the higheſt; and yet the knowledge of the higheſt, is infinitely more perfect and admirable, then the knowledge of his inferiours: then, and not before, we ſhall throughly comprehend this myſtery. In the meane time, it is enough for vs, that we are ſure, that thus it faireth with ſoules: and that by how much the excellency and perfection of an allknowing and all comprehending ſoule, deliuered out of the body of a wretched embryon, is aboue the vileneſſe of that heauy lumpe of flesh, it lately quitted in his mothers wombe; euen by ſo much, and according to the ſame proportion, muſt the excellency of a complete ſoule (completed in its body) be in a pitch aboue the adorable maieſty, wiſedome, and auguſtneſſe, of the greateſt and moſt admired oracle in the world, liuing embodyed in flesh and bloud. Which as it is in a height, and eminency ouer ſuch an excellent and admirable man, infinitely beyond the exceſſe of ſuch a man, ouer that ſeely lumpe of flesh, which compoſeth the moſt contemptible idiote or embryon; ſo likewiſe, is the exceſſe of it, ouer the ſoule of an abortiue embryon, (though by the ſeparation, growne neuer ſo knowing, and neuer ſo perfect) infinitely greater, then the dignity and wiſedome of ſuch a man, is aboue the feebleneſſe and miſery of an new animated child. Therefore haue patience my ſoule: repine not at thy longer ſtay here in this vale of miſery, where thou art banished from thoſe vñſpeakable ioyes thou ſeeſt att hand before thee; from which nothing but the fraile walles of rotten flesh ſeuereth thee. Thou ſhalſt haue an ouerflowing reward for thy enduring and patienting in this thy darkeſome priſon. Depriue not thy ſelfe through miſchieuous haſt, of the great hopes and admirable felicity that attend thee, canſt thou but with due temper ſtay for it. Be content to lett thy ſtocke lye out awhile at intereſt; thy profits will come in vaſt proportions; and euery yeare, euery day, euery houre, will pay thee intereſt vpon intereſt: and the longer it runneth on, the more it multiplyeth: and in the account thou ſhalſt find, if thou proceedeſt as thou ſhouldeſt, that one moment oftentimes bringeth in a greater encreaſe vnto thy ſtocke of treaſure, then the many yeares thou didſt liue and trade before: and the longer thou liueſt, the thicker will theſe moments arriue vnto thee. In like manner as in Arithmetical numeration, euery addition of the leaſt figure, multiplyeth the whole ſumme it findeth. Here thou wilſt proue how true that rich man ſayed, who of his gaines pronounced, that he had gotten litle with great labour, and great ſummes with litle: ſo if thou beſtoweſt well thy time, thy latter ſummes will bring thee in huge accountes of gaine, vpon ſmall expence of paines or employments; whereas thy firſt beginnings are toyleſome and full of paine, and bring in but ſlender profitt.

By this time, my ſoule, I am ſure thou art ſatisfied, that the exceſſe of knowledge and of pleaſure, which in the next life thou ſhalt enioy, is

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vaſtly beyond any thou art capable of here. But how may wee eſtimate the iuſt proportion they haue to one on other? Or rather is not the pleaſure of a ſeparated ſoule, ſo infinitely beyond all that can be relished by one embodied here in clay, that there is no proportion betweene them? At the leaſt, though wee are not able to meaſure the one, lett vs do our beſt to ayme and gueſſe at the improportion betweene them; and reioyce when wee find that it is beyond our reach to conceiue or imagine any thing, nigh the truth and the huge exceſſe of thy good (my ſoule) ouer the moſt I am capable of in this world. It is agreed, that the vehemence and intenſeneſſe of any pleaſure, is proportionable to the actiuity, power, and energy of the ſubiect, which is affected with ſuch pleaſure; and to the grauitation, bent, and greatneſſe, that ſuch a ſubiect hath to the obiect that delighteth it. Now to roue at the force and actiuity, wherewith a ſeparated ſoule weigheth and ſtriueth to ioyne it ſelfe, to what its nature carrieth it vnto; lett vs beginne with conſidering the proportions of celerity and forcibleneſſe, wherewith heauy bodies moue downewards. I ſee a pound weight in one ſcale of the ballance, weigheth vp the other empty one withgreat celerity. But if in to that you imagine a million of poundes to be put, you may well conceiue, that this great exceſſe, would carry vp the ſingle pound weight with ſo much violence and ſpeede, as would hardly afford your eye liberty to obſerue the velocity of the motion. Lett me multiply this million of poundes, by the whole globe of the earth; by the vaſt extent of the great orbe, made by the ſunnes, or earthes motion about the center of the world; by the incomprehenſibility of that immenſe ſtore-houſe of matter and of bodies, which is deſigned in lumpe by the name of the Vniuerſe; of which we know no more, but that it is beyond all hope of being knowne, during this mortall life. Thus when I haue heaped together a bulke of weight, equall to this vnwieldy machine; lett me multiply the ſtrength of its velocity, and preſſure ouer the leaſt atome imaginable in nature, as farre beyond the limits of grauity, as the ingenious skill, wherewith Archimedes numbred the leaſt graines of ſand that would fill the world, can carry it: and when I haue thus wearied my ſelfe, and exhauſted the power of Arithmetike, and of Algebra, I find there is ſtill a proportion betweene that atome and this vnutterable weight: I ſee it is all quantitatiue; it is all finite; and all this exceſſe vannisheth to nothing, and becommeth inuiſible (like twinkling ſtarres, at the riſing of the much brighter ſunne) as ſoone as the loweſt and the meaneſt ſubſtance shineth out of that orbe, where they reſide that ſcorne diuiſibilility, and are out of the reach of quantity and matter. How vehement then muſt the actiuity and energy be, wherewith ſo puiſſant a ſubſtance shooteth it ſelfe to its deſired obiect? and when it enioyeth it, how violent muſt the extaſy and tranſport be, wherewith it is delighted? How is it poſſible then for my narrow hart, to frame an apprehenſion of the infinite exceſſe of thy pleaſure (my ſoule) ouer all

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pleaſure this limited world can afford, which is all meaſured by ſuch petty proportions? How should I ſtampe a figure of thy immenſe greatneſſe, into my materiall imagination? Here I looſe my power of ſpeaking, becauſe I haue too much to ſpeake of: I muſt become ſilent and dumbe, becauſe all the words and language I can vſe, expreſſe not the thouſandeth, nor the millioneth part, of what I euidently ſee to be treu. All I can ſay is, that whatſoeuer I thinke or imagine, it is not that: and that it is not like any of thoſe things; vnto ſome of which vnleſſe it be like, it is impoſſible for me to make any proportion or ſimilitude vnto it. What then shall I do, but lay my ſelfe downe in mine owne shadow, and there reioyce that thou art a light ſo great, as I am not able to endure the dazeling ſplendour of thy rayes: that thy pleaſure is ſo exceſſiue, as no part of it can enter into my circumſcribed hart, without dilating it ſo wide, that it muſt breake in ſunder: and that thy happineſſe is ſo infinite, as the higheſt pitch I can hope for to glutt my ſelfe withall, during this darke night of my tedious pilgrimage here on earth, is to ſee euidently, that it is impoſſible for me in this life, to frame any ſcantling of it; much leſſe, to know how great it is. Shall I then once againe preſume to breake out into impatience, at my delay of ſo great bliſſe, and crye out, that I am content with the meaneſt share of this exuberant felicity? I care not for the exaggerations which a longer life may heape vp vnto it. I am ſure here is ſufficient to ſwell my hart beyond it ſelfe, to ſatisfie my thirſty ſoule, to diſſolue and melt all my powers, and to transforme me totally into a ſelfebleſſed creature. Away, away all tedious hopes, not only of this life, but euen of all encreaſe in the next. I will leape bouldly into that fountaine of bliſſe, and caſt my ſelfe headlong into that ſea of felicity; where I can neither apprehend shallow waters, nor feare I shall be ſo litle immerſed and drowned, as to meete with any shelfe or dry ground, to moderate and ſtinte my happineſſe. A ſelfe actiuity, and vnbounded extent, and eſſence free from time and place, aſſure me ſufficiently, that I neede deſire no more. Which way ſoeuer I looke, I looſe my ſight, in ſeeing an infinity round about me. Length without pointes: Breadth without Lines: Depth without any ſurface. All content, all pleaſure, all reſtleſſe reſt, all an vnquietneſſe and tranſport of delight, all an extaſy of fruition.

Happy forgetfulneſſe, how deepely am I obliged to thee, for making roome for this ſoule rauishing contemplation, by remouing this whiles all other images of things farre from me? I would to God thou mighteſt endure, whiles I endure; that ſo I might be drowned in this preſent thought, and neuer wake againe, but into the enioying, and accompletion of my preſent enflamed deſires. But alas, that may not be. The eternal light whom my ſoule and I haue choſen for Arbiter, to determine vnto vs what is moſt expedient for vs, will not permit it. We muſt returne; and that into feares and miſeries: For as a good life breedeth encreaſe of happineſſe, ſo doth an euell one, heape vp Iliades of woe.

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Firſt (my ſoule) before I venture, we ſhould be certaine, that thy parting from this life, waft thee ouer to aſſured happineſſe: For thou well knoweſt, that there are noxious actions, which depraue and infect the ſoule, whiles it is forging and moulding here it its body, and tempering for its future being: and if thou ſhouldeſt ſally hence in ſuch a peruerſe diſpoſition, vnhappineſſe would betyde thee inſteed of thy preſumed bliſſe. I ſee ſome men ſo rauenous after thoſe pleaſures, which cannot be enioyed out of the body, that if thoſe impotent deſires accompany their ſoules into eternity, I can not doubt of their enduring an eternity of miſery: I can not doubt of their being tormented with ſuch a dire extremity, of vnſatisfyable deſire and violent greife, as were able to teare all this world into pieces, were it conuerted into one hart; and to riue in ſunder, any thing leſſe then the neceſſity of contradiction. How high the bliſſe of a well gouerned ſoule is aboue all power of quantity, ſo extreme muſt the rauenous inclemency, and vulturelike cruelty, be of ſuch an vncompaſſable deſire gnawing eternally vpon the ſoule; for the ſame reaſon holdeth in both: and whichway ſoeuer the grauitation and deſires of a ſeparated ſoule do carry it, it is hurried on with a like impetuoſity and vnlimited actiuity. Lett me then caſt an heedfull and wary eye, vpon the actions of the generality of mankind, from whence I may gueſſe at the weale or woe, of their future ſtate: and if I find that the greateſt number weigheth downe in the ſcale of miſery, haue I not reaſon to feare leaſt my lott ſhould prooue among theirs? For the greateſt part ſweepeth along with it euery particular, that hath not ſome particular reaſon to exempt it from the generall law. Inſteede then of a few that wiſely ſettle their hartes on legitimate deſires, what multitudes of wretched men do I ſee; ſome hungry after flesh and bloud; others gaping after the empty wind of honour and vanity; others breathing nothing but ambitious thoughts; others graſping all, and groueling vpon heapes of melted earth? So that they put me all in a horrour, and make me feare, leaſt very few they be, that are exempted from the dreadfull fate of this incomprehenſible miſery, to which I ſee, and grieue to ſee, the whole face of mankind deſperately turned. May it not then be my ſad chance, to be one of their vnhappy number? Be content then, fond man, to liue. Liue yet, till thou haſt firſt ſecured the paſſage which thou art but once to venture on. Be ſure before thou throweſt thy ſelfe into it, to put thy ſoule into the ſcales: ballance all thy thougths; examine all thy inclinations; put thy ſelfe to the teſte, try what droſſe, what pure gold is in thy ſelfe: and what thou findeſt wanting, be ſure to ſupply, before nature calleth thee to thy dreadfull account. It is ſoone done, if thou beeſt what thy nature dictateth thee to be. Follow but euident reaſon and knowledge, and thy wantes are ſupplyed, thy accountes are made vp. The ſame euershining truth, which maketh thee ſee that two and two are foure, will shew thee without any contradiction, how all theſe baſe allurements are vaine and idle; and that there is no compariſon

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betweene the higheſt of them, and the meaneſt of what thou mayeſt hope for, haſt thou but ſtrength to ſettle thy hart by the ſteerage of this moſt euident ſcience; in this very moment, thou mayſt be ſecure. But the hazard is great, in miſſing to examine thy ſelfe truly and throughly. And if thou miſcarry there, thou art loſt for euer. Apply therefore all thy care, all thy induſtry to that. Lett that be thy continuall ſtudy, and thy perpetuall entertainement. Thinke nothing elſe worth the knowing, nothing elſe worth the doing, but ſcrewing vp thy ſoule vnto this hight, but directing it by this leuell, by this rule. Then feare not, nor admit the leaſt doubt of thy being happy, when thy time ſhall come; and that time ſhall haue no more power ouer thee. In the meane ſeaſon, ſpare no paines, forbeare no diligence, employ all exactneſſe, burne in ſummer, freeſe in winter, watch by night, and labour by day, ioyne monthes to monthes, and entayle yeares vpon yeares. Thinke nothing ſufficient to preuent ſo maine a hazard; and deeme nothing long or tedious in this life, to purchace ſo happy an eternity. The firſt diſcouerers of the Indies, caſt themſelues among ſwarmes of maneaters; they fought and ſtrugled with vnknowne waues; ſo horrid ones, that oftentimes they perſwaded themſelues they climbed vp mountaines of waters, and ſtraight againe were precipitated headlong downe betweene the clouen ſea, vpon the foaming ſand, from whence they could not hope for a reſource: hunger was their foode; ſnakes and ſerpents were their daynties; ſword and fire were their dayly exerciſe: and all this, only to be maſters of a litle gold, which after a short poſſeſſion was to quitt them for euer. Our ſearchers after the Northerne paſſage, haue cutt their way through mountaines of yce, more affrightfull and horrid, then the Symplegades. They haue impriſoned themſelues in halfe yeare nights; they haue chayned themſelues in perpetuall ſtonecleauing coldes: ſome haue beene found cloſely embracing one an other, to conſerue as long as they were able, a litle fewell in their freeſing harts, at lenght petrifyed by the hardneſſe of that vnmercifull winter: others haue beene made the prey of vnhumane men, more ſauage then the wildeſt beaſts: others haue beene neuer found nor heard of, ſo that ſurely they haue proued the foode of the vgly monſters of that vaſt ycy ſea: and theſe haue beene able and vnderſtanding men. What motiues, what hopes had theſe daring men? What gaines could they promiſe themſelues, to counteruaile their deſperate attempts? They aymed not ſo much as at the purchaſe of any treaſure for themſelues, but meerely to ſecond the deſires of thoſe that ſett them on worke; or to fill the mouthes of others, from whence ſome few crummes might fall to them. What is required at thy hands (my ſoule) like this? And yet the hazard thou art to auoyde, and the wealth thou art to attaine vnto, incomparably ouerſetteth all that they could hope for. Liue then and be glad of long and numerous yeares; that like ripe fruite, thou mayſt droppe ſecurely into that paſſage, which duely entered into, ſhall deliuer thee into an

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eternity of bliſſe, and of vnperishable happineſſe.

And yet (my ſoule) be thou not too ſoare agaſt, with the apprehenſion of the dreadfull hazard thou art in. Lett not a tormenting feare of the dangers that ſurround thee, make thy whole life here bitter and vncomfortable to thee. Lett the ſerious and due conſideration of them, arme thee with caution and with wiſedome, to preuent miſcarriage by them. But to looke vpon them with horrour and affrightedneſſe, would freeſe thy ſpirits, and benumme thy actions, and peraduenture engulfe thee through puſillanimity in as great miſcheifes, as thou ſeekeſt to auoyde. Tis true, the harme which would acrue from miſgouerning thy paſſage out of this life, is vnſpeakable, is vnimaginable. But why shouldeſt thou take ſo deepe thought of the hazard thou runneſt therein, as though the difficulty of auoyding it were ſo extreme, as might amounte to an impoſſibility. I allow, the thoughts that arme thee with wiſe caution to ſecure thy ſelfe, cannot be too deepe nor too ſerious; but when thou haſt prouidently ſtored thy ſelfe with ſuch, call thy ſpirits manfully about thee: and to incourage thee to fight confidently, or rather to ſecure thee of victory, ſo thou wilt not forſake thy ſelfe, turne thine eyes round about thee, and conſider how wiſe nature, that hath preſcribed an end and periode vnto all her plantes, hath furnished them all with due and orderly meanes to attaine thereunto: and though particulars ſometimes miſcarry in their iourney (ſince contingence is entayled to all created things) yet in the generality, and for the moſt part, they all arriue vnto the ſcope she leuelleth them at. Why then should we imagine, that ſo iudicious and farre looking an Architect, whom we ſee ſo accurate in his meaner workes, should haue framed this Maſterpiece of the world, to perish by the way, and neuer to attaine vnto that great end, for which he made it; euen after he is prepared and armed with all aduantagiouſe circumſtances agreeable to his nature. That artificer, we know, deſerueth the ſtyle of ſeely, who frameth ſuch tooles, as fayle in there performance, when they are applyed to the action for which they were intended. We ſee all ſortes of trees for the moſt part beare their fruite in the due ſeaſon; which is the end they are deſigned vnto, and the laſt and higheſt emolument they are made to afford vs. Few beaſts we ſee there are, but contribute to our ſeruice what we looke for at their hands. The ſwine affordeth good flesh, the sheepe good wooll, the cow good milke, the ſable warme and ſoft furre, the oxe bendeth his ſturdy necke to the yoke, the ſpiritfull horſe dutyfully beareth the ſoldier, and the ſinewy mule and ſtronger camel conuey weighty marchandiſe. Why then shall euen the better ſort of mankind, the chiefe, the toppe, the head, of all the workes of nature, be apprehended to miſcarry from his end in ſo vaſt a proportion, as that it should be deemed in a manner impoſſible, euen for thoſe few (for ſo they are in reſpect of the other numerous multitude of the worſer ſort) to attaine vnto that felicity which is naturall vnto them? Thou (my ſoule) art the forme, and that

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ſupreme part of me, which giueth being both to me and to my body: who then can doubt, but that all the reſt of me, is framed fitting and ſeruiceable for thee? For what reaſon were there, that thou shouldeſt be implanted in a ſoyle, which can not beare thy fruite? The forme of a hogge, I ſee, is engrafted in a body fitt and appropriated for a ſwines operations: the forme of a horſe, of a lyon, of a wolfe, all of them haue their organes proportioned to the maſtering piece within them, their ſoule. And is it credible, that only man, should haue his inferiour partes raiſed ſo highly in rebellion againſt his ſoule, the greateſt Miſtreſſe (beyond proportion) among all formes, as that it shall be impoſſible for her to ſuppreſſe their mutinies, though she guide her ſelfe neuer ſo exactly by the preſcripts of that rule, which is borne with her? Can it be ſuſpected, that his forme, which is infinitely mounted aboue the power of matter, should through the very neceſſity and principles of its owne nature, be more lyable to contingency, then thoſe that are engulfed and drowned in it; ſince we know, that contingency, defectibility, and change, are the lame children of groſſe and miſshapen matter?

Alas it is too true, that nature is in vs vnhappily wreſted from her originall and due courſe. We find by ſad experience, that although her depravation be not ſo totall, as to blind entirely the eye of Reaſon she ſeeth by, yet it is ſo great, as to carry vehemently our affections quite croſſe to what she propoſeth vs as beſt. Howſoeuer, lett the incentiues of flesh and bloud be neuer ſo violent, to tumble humane nature downe the hill, yet if a contrary force, more efficacious then they with all their turbulent and miſty ſteames, do impell it an other way, it muſt needes obey that ſtronger power. Lett vs then examine whoſe motiues, the ſoules, or the ſenſes, in their owne nature, worke moſt efficaciouſly in man. We are ſure, that what pleaſure he receiueth, he receiueth by meanes of his ſoule; euen all corporeall pleaſure: for, be the working obiect neuer ſo agreeable and pleaſing vnto him, he reapeth thence ſmall delight, if in the meane time, his ſoules attention be carried an other way from it. Certainely then, thoſe thinges muſt affect the ſoule moſt powerfully, which are connaturall vnto her, and which she ſeiſeth vpon and reliſheth immediately; rather then thoſe impure ones, which come ſofiſticated to her, through the muddy channels of the ſenſes. And accordingly, all experience teacheth vs, that her pleaſures, when they are fully ſauored, are much ſtronger then the pleaſures of our ſenſe. Obſerue but the different comportements of an ambitious, and of a ſenſuall man: and you will euidently perceiue farre ſtronger motions, and more vehement ſtraines in the former, who hath his deſires bent to the ſatisfaction of his mind; then in the other, who aimeth but att the pleaſures of his body. Lett vs looke vpon the common face of mankind; and we shall ſee the moſt illuſtrious and noble part, taken with learning, with power, with honour; and the other part, which maketh ſenſe their idole, moueth in a lower and baſer orbe vnder the others; and is in a ſeruile degree to

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them. Since then humane nature is of it selfe more enclined to the contentments of the actiue mind, then of the dull sense; who can doubt but that the way of those pure contentments, must be farre sweeter then the grosse and troubled streames of sensuall pleasures: which if it be, certainely man in his owne nature, is more apt to follow that: and when he chanceth to wander out of that smooth and easy roade, his steppes are painefull and wearisome ones: and if he do not presently perceiue them such, it is, because it fareth with him, as with those that walke in their sleepe, and stray into rough and stony passages, or among thistles and bryars; whiles peraduenture some illuding dreame bewitcheth their fansyes, and perswadeth them they are in some pleasant garden; till waking (if att least they wake before they fall into a deadly precipice) they finde their feete all gored, and their bodies all scratched and torne. If any sensuall man should doubt of this great truth, and find it hard to perswade himselfe, that intellectuall pleasures (which to his depraued taste, seeme cold and flatt ones) should be more actiue and intense, then those feculent ones, which so violently transporte him; lett him but exercise himselfe a while in those entertainements which delight the mind, taking leaue, during that space, of those vnruly ones, which agitate the body; and continue doing thus, till by long practise, he hath made them easy and habituated himselfe vnto them: and I will engage my word, that he will find this change so aduantageous to him, euen in contentment and delight, that he will not easily be brought backe to his former course of life. Experience sheweth vs, that whatsoeuer is long customary to vs, turneth into our nature; so much, that euen diseases and poisons by diuturne vse, do mould and temper to themselues those bodies, which are habituated to them; in such sort, that those pestes of nature must be kept on foote, and fed vpon for our subsistence. How much more then must the most connaturall exercise of mentall pleasure, turne so substantially into our being, that after some good practice in it, we shall not be able, with out great struggling and reluctation, to liue without it?

The violence of fruition in those foule puddles of flesh and bloud, presently glutteth with satiety, and is attended with annoy and with dislike: and the often vsing and repeating it, weareth away that edge of pleasure, which only maketh it sweete and valuable, euen to them that sett their hartes vpon it; and nothing heighteneth it, but an irritation by a conuenient hunger and abstinence. Contrarywise, in the soule, the greater and more violent the pleasure is, the more intense and vehement the fruition is; and the oftner it is repeated, so much the greater appetite and desire we haue, to returne vnto the same; and nothing prouoketh vs more, then the entire and absolute fruition of it. If a suddaine change from one extreme of flesh and bloud, to the other opposite pole of spirituall delights and entertainements, seeme harsh to him, whose thoughts by long assuefaction, are glewed to corporeall

corporeall obiects; lett him beginne with gently brideling in his inferiour motions vnder a faire rule of gouernement: If he can not presently suppresse and totally mortify their clamorous desires, lett him att the least moderate and steere them according to the bent of reason. If we will but follow this course which nature teacheth vs, to heighten euen our sensuall delights and pleasures, by reasonable moderation of them to their owne aduantage; we shall find her so kind a mother to vs, that of her selfe she will at length quelle and disincomber vs of all our enemies. If wee but temperately attend her worke, she will quietly waft vs ouer to our desired end, to our beloued happinesse. In a few yeares, by boyling away our vnruly heate, she will abate, and in the end quite weare away the sense of those transporting pleasures, we vsed to take so much delight in the fruition of. With in a while, rheumes will so clogge our tongue and palates, that we shall but flatly relish the most poinant meates. Our dulled eares will no longer deuoure with delight, the rauishing sound of sweete harmonies. Our dimme eyes will carry to our heauy fansie but confused newes of any beautifull and pleasing obiects. Our stopped nosethriles will afford no passage for spiritefull perfumes, to warme and recreate our moyst and drowsie braine. In a word, nature will ere long, warne vs to take a long farewell of all those contentments and delights, which require a strong, vigorous, and athletike habite of body to enioy. She will shew vs, by setting our graues before our eyes, how vaine this glittering fansie of honour is: how vnprofitable the staffe of power to vnderproppe our falling being: how more burthensome then helpefull are those massie heapes of gold and siluer, which when we haue, the greatest vse we make of them, is but to looke vpon them, and court them with our dazeled eyes; whiles they encompasse vs with armies of traytours and of hungry wolues, to teare them from vs, and vs in pieces for their sake. Thus will nature of her selfe in a short time, dull those weapons that offend vs, and destroy the enimies of those verities that shine vpon vs. Courage then, my Soule, and neyther feare to liue, nor yet desire to dye. If thou continuest in thy body, it is easy for thee, and sweete and contentsome, to heape vp treasures for eternity. And if thou partest from it, thy hopes are great and faire, that the iourney thou art going, is to a world of vnknowne felicity. Take hart then, and march on with a secure diligence, and expect the hand of bounteous nature, to dispose of thee, according as she hath wisely and benignely prouided for thee. And feare not but that if thou hast kept a reasonable amity with her, she will passe thee to where thou shalt neuer more be in danger of iarring with her; nor of feeling within thy selfe the vnkind blowes of contrary powers fighting in thee, whiles thou bleedest with the woundes that each side giueth; nor of changing thy once gained happinesse into a contrary condition, according to the vicissitudes of all humane affaires. But shalt *For euer*, be swelled to the vtmost extent of thy infinite nature, with this torrent, with this abisse of ioy, pleasure, and delight.

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But here (my Soule) well mayeſt thou ſtand amazed att this great word *Foreuer*. What will this be, when fleeting time shall be conuerted into permanent eternity? Sharpen thy ſight to looke into this vaſt profundity. Suppoſe that halfe an houre, were reſumed into one inſtant or indiuiſible of time: what a ſtrange kind of durance would that be? I ſee that halfe an houre, is diuiſible without end, into halfes, and halfes of halfes, and quarters of quarters; and after myriades of diuiſions, no parcell is ſo litle, but thar it hath an infinite ſuperproportion to an indiuiſible inſtant. What a prodigious thing then muſt it be, to haue an inſtant equaliſe halfe an houre? Were it but ſome ordinary notion or quiddity, as of magnitude, of place, of actiuity, or the like, in which this excellency of an indiuiſibles equaliſing a large extent, were conſidered; my fantaſy would offer to wreſtle with it; and peraduenture, by ſtrong abſtraction, and by deepe retirement into the cloſet of iudgement, I might hazard to frame ſome likeneſſe of it. But that wherein this multiplication is, is the nobleſt, the higheſt, and the roote of all other notions, it is *Being* and *Exiſtence* it ſelfe. I my ſelfe, whiles I am, haue my exiſtence determined but to one poore inſtant of time; and beyond that, I am aſſured of nothing. My ſlender thridde of *Being* may breake a ſunder, as neere to that inſtant, as I can ſuppoſe any thing to be neere vnto it: and when I shall haue ſuppoſed, *Here* it may breake, I ſtill find that it may breake neerer and neerer; and that I can neuer arriue to ſettle the neereſt point where it may ſnapp in two. But when time shall be no more; or att the leaſt, shall in reſpect of me, be turned into Eternity; then this fraile Exiſtence of mine, will be ſtretched, out beyond the extent of all conquering time. What ſtrange thing then, is this admirable multiplication of exiſtence? or how may I be able to comprehend it? Exiſtence is that which comprehendeth all thinges: and if God be not comprehended in it, thereby it is, that he is incomprehenſible of vs: and he is not comprehended in it, becauſe himſelfe is it. He is Exiſtence: and by being ſo, he equaleth, not comprehendeth it. From hence then I may gather the excellency and waſt empire of exiſtence, in its owne nature: and ſo conclude how admirable a change and betterment that muſt be, which encreaſeth, and multiplyeth ſo infinitely the exiſtence I now enioy: for be it neuer ſo ſpecious; be it neuer ſo glorious; be it what it is, exiſtence, the toppe, the flower, the perfection of all created thinges; ſtill there is a flaw, there is a defect, a ſhorteneſſe, a limitation in it: for now, my ſoule, thou art but a part of me; and doeſt exiſt in ſuch a manner by ſucceſſion, that the ſecurity and poſſeſſion of it, is of leſſe then of any thing whatſoeuer in the world; for it is of nothing more, then of an indiuiſible; which being ſuch, in truth is nothing. But when the walles shall be broken downe, that here confine thee to ſuch a nothing of exiſtence, (which yet is infinitely more noble, then all other degrees of notions) then thou shalleſt ſumme vp time in formall *being*, and

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not be limited, as now thou art, to this ſo diuided a ſucceſſion. Thou ſhalleſt be an houre without diuiſibility: and if an houre, a yeare: if ſo, an age: and if an age, then for euer, for al eternity.

But whither art thou flowne, my ſoule? to what a dazeling height art thou mounted? Thou art now ſoared to ſuch a leſſening pitch, as my faint eyes are no longer able to follow thy touring flight: my head groweth giddy, with gazing vp; whiles thou lookeſt downe, to ſee time runne an infinite diſtance beneath thee; wafting the exiſtences of all corporeall thinges from nothing to nothing, in a perpetuall ſtreame: and thou ſecure, and out of the reach of its venimous and alldeſtroying tooth. Lett me call to minde, all the violent pleaſures of my heady youth: lett me ſumme vp their extent according to thoſe deceatfull meaſures I then rated happineſſe by: lett me in my fancy chew ouer againe the exceſſiue good, I then fondly imagined in them: and to all this, lett me adde as much more ioy and felicity, as in my weake thoughts, I am able to faddome or but ayme att: and then lett me ſay (and with rigorous truth I ſhall ſay it) all this exceſſe of bliſſe, will be reſumed, will be enioyed to the full, in one indiuiſible moment: lett me thinke with my ſelfe, if then, when pleaſure was the Idole I ſacrificed all my thoughts vnto, I might in one quarter of an houre haue enioyed a pleaſure, or att the leaſt, haue hoped for one, that ſhould haue equaliſed att once all thoſe, that in my life I euer taſted: what would not I haue beene content to giue in purchaſe of that ſingle quarter of an houre? And inſteed of this pleaſant dreame, I now ſee that one reall moment, will truly and ſolidely giue to thee and me, the quinteſſence, the Elixir of content and happineſſe; not drawne out of ſuch 40 yeares, as I haue ſtruggled through the world in various fortunes; but out of ages and ages of pleaſure, greater farre then can be conceiued by a hart of flesh; and multiplyed beyond the Arithmetike of intelligences. And this happy moment, ſhall not be of their ſoddaine fleeting and expiring nature, that are aſſigned to time; but ſhall endure beyond the extent of that time, which ſurpaſſeth all multiplication. I ſee plainely that I muſt multiply eternity by eternity, to frame a ſcantling of that bliſſe, which a well paſſed life in this world, ſhall bring me to in the next. And yet it will be as farre short, and as much beneath the ſelfebleſſedneſſe of him that giueth one this, as nothing is short of all that is. For my bliſſe ſhall haue a beginning; and though it neuer ſhall haue end, yet that belongeth not to it for its owne ſake, but proceedeth meerely from the bounteous hand of the nothing annihilating ſelfe eſſence: from whom there is no more feare of the fayling of his liberall ſupereffluence of *Being* vpon me, then there is of his owne deficiency from being ſelfe *Being*. But how can theſe thinges ſtand together? That indiuiſibly I ſhall poſſeſſe a tenure beyond all poſſible time? and neuertheleſſe *poſsibly*, not withſtanding my poſſeſſion, I may be bereft of what I enioy? who can reade this riddle? who can diue into

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this abiſſe? who can shoote light into this infinite pitte of darkeneſſe? It is the aboundance and exceſſe of light that here ſtriketh vs blind. Who can ſtrengthen our eyes to endure eaglewile this glorious and reſplendent ſunne? Nothing ſurely in this world; vnleſſe it be ſilẽce and ſolitude. To theſe therefore lett vs conſecrate the reuerend contemplation of this awefull myſtery: which is but profaned, if it be expoſed to vulgar eyes; and to ſuch nightowles and battes as we are, whiles the troubled fantaſies of reeking ſenſe and wordly occupations, do ouercloud our myſty thoughts.

Now then if nature by short and thicke ſteppes att the beginning, and by larger paces in the progreſſe, hath deliuered vs ouer into a night of pure light, where we can ſee nothing, becauſe euery thing is too viſible; ſo that we are faine to veyle our eyes, and are conſtrayned to retire ourſelues to medicate and arme them, before we expoſe them to ſo ſtrong and glorious beames: how should we dare to looke vpon thoſe admirable heights (infinitely ſurpaſſing all theſe) with which the ouerconquering Grace hath crowned and ſwelled vp the extent of nature? What ſight is sharpe enough to penetrate into the myſterious eſſence, ſprouting into different perſons? Who can looke vpon the ſelfe multiplyed vnity, vpon the incomprehenſible circumince ſſion, vpon thoſe wondrous proceſſions, and idiomes reſerued for Angels eyes?

Of theſe, (my ſoule) whoſe shootinges reach infinitely higher beyond all that we haue ſaid, then what we haue ſayd is beyond the dull and muddy motions of this life; thou art not capable now of receiuing any inſtructions: lett firſt the myſtagogicall illuminations of the great Areopagite; and the Aſcetike diſcipline of the Anachoreticall inhabitants of the wilderneſſe, purify thy eye, before thou attempteſt to ſpeake, or to ayme att the diſcouery of theſe abiſming depths. By them thou muſt be firſt irrigated with the ſweete shoures of morninges and eueninges, with the gentle deawes, and mannadroppes, which fall aboundantly from thoſe bounteous fauours that reſide in a higher ſphere then nature; and that poure out, vnknowne and vnconceiuable bleſſinges vpon prepared hartes: which fructify into that true bliſſe, in compariſon where of, all that we haue hitherto declared, is but shaddow, vanity, and nothing.

FINIS.

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PRIVILEGE DV ROY.

LOVYS PAR LA GRACE DE DIEV ROY DE FRANCE ET DE NAVARRE, A nos amez & feaux les gens tenans nos Cours de Parlemens, Baillifs, Seneſchaux, Preuoſts, leurs Lieutenans, & tous autres nos Iuſticiers & Officiers qu'il appartiendra, Salut, *Le Sieur Kenelme Digby Cheualier Anglois, nous a fait remonſtrer qu'il a composé vn Liure en langue Angloiſe, contenant deux Traitez, l'vn de la nature du corps, & l'autre de la nature des ames, auec vne recherche de l'immortalité de celles qui ſont raiſonnables.* Lequel il deſireroit mettre en lumiere & faire imprimer, s'il auoit nos lettres à ce neceſſaires: leſquelles nous faiſant ſupplier luy vouloir octroyer. A ces cauſes luy auons permis & accordé, permettons & accordons par ces preſentes faire imprimer & debiter ledit Liure pendant ſix ans. Durant leſquels nous faiſons deffenſes à tous Libraires & Imprimeurs de noſtredit Royaume, de l'imprimer vendre, ny debiter, ſoit ſous quelque marque de déguiſement ou traduction que ce ſoit, ſans le conſentement dudit ſieur Digby, à peine de trois mille liures d'amende, confiſcation des exemplaires qui s'en trouueront, & de tous deſpens dommages & intereſts enuers luy. Si vous mandons & à chacun de vous enioignons tenir la main à l'execution des preſentes, leſquelles voulons eſtre tenuës pour deuëment ſignifiées, en mettant copie d'icelles au commencement ou à la fin de chacun deſdits Liures. A la charge de mettre

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par ledit ſieur Digby vne exemplaire dudit Liure en noſtre Biblioteque, & vne autre en celle de noſtre tres-cher & feal Chancelier, à peine de nullité deſdites preſentes. Car tel eſt noſtre plaiſir, nonobſtant oppoſitions ou appellations quelconques, clameur de Haro, chartre Normande, & lettres à ce contraires. Donné à Fontainebleau le vingt-ſixieſme iour de Septembre, l'an de grace mil ſix cens quarante-quatre, & de noſtre Regne le deuxieſme.

Par le Roy en ſon Conſeil,

GVITONNEAV.

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